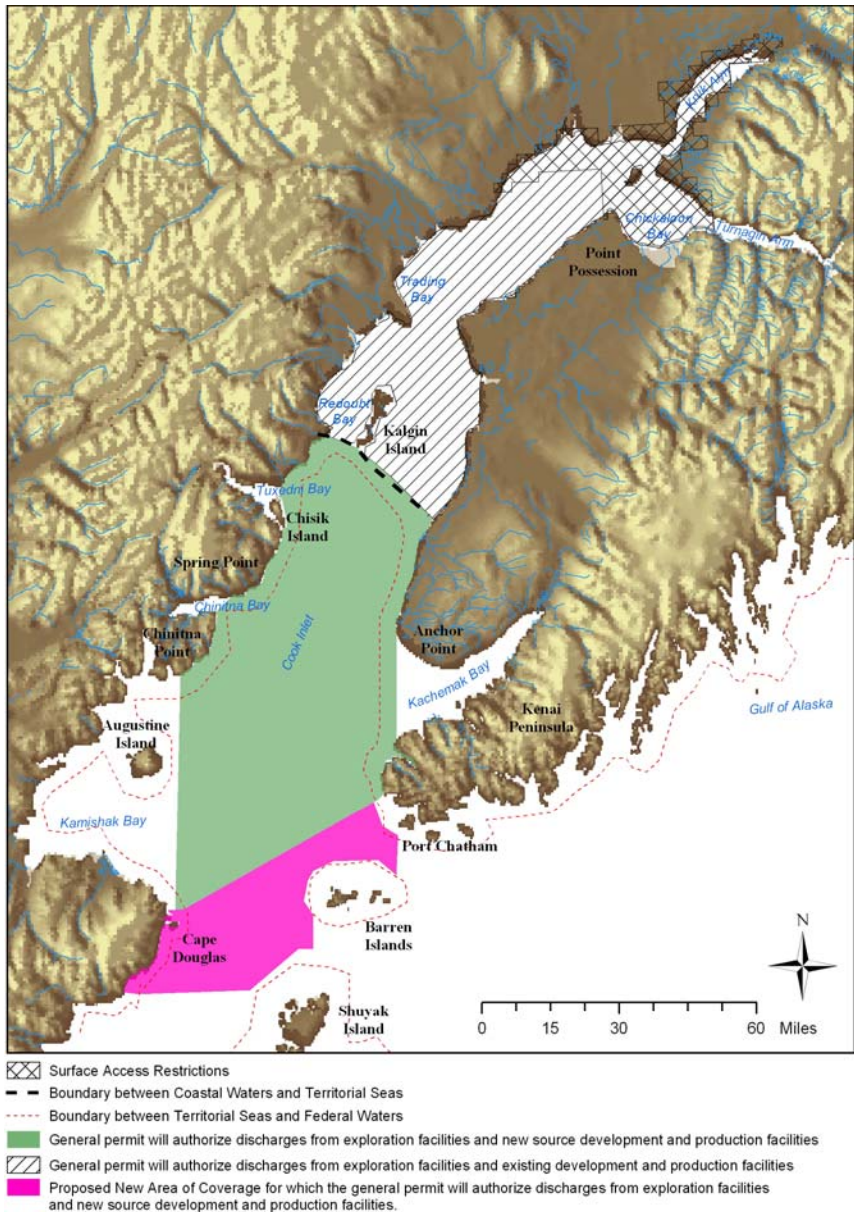
United States
Environmental Protection
Agency

Region 10
1200 Sixth Avenue
Seattle, WA 98101

Alaska
Idaho
Oregon
Washington

ESSENTIAL FISH HABITAT ASSESSMENT FOR THE COOK INLET NPDES PERMIT



January 20, 2006

Prepared for:
U.S. Environmental Protection Agency, Region 10
Office of Water
NPDES Permits Unit

Prepared by:
Tetra Tech, Inc.
6100 219th Street, SW, #550
Mountlake Terrace, WA 98043

CONTENTS

LIST OF ACRONYMS

ADEC	Alaska Department of Environmental Conservation
AMSA	Area Meriting Special Attention
API	American Petroleum Institute
BAT	Best available pollution control technology economically achievable
BCT	Best conventional pollution control technologies
BE	Biological Evaluation
BOD	Biochemical Oxygen Demand
BPT	Best Practicable Control Technology
CFR	Code of Federal Regulations
CHA	Critical habitat area
CWA	Clean Water Act
DMR	Discharge Monitoring Report
EEZ	exclusive economic zone
EFH	essential fish habitat
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FMP	fisheries management plan
g	gram
GC/MS	Gas Chromatography/Mass Spectrometry
gpd	Gallons per day
m	Meter
mg/L	Milligrams per liter
mL	Milliliter
MLLW	Mean lower low water
MMS	Minerals Management Service
MSD	Marine Sanitation Device
NAF	nonaqueous drilling fluids
NMFS	National Marine Fisheries Service
NOAA Fisheries	National Oceanic and Atmospheric Administration's National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
OCS	Outer Continental Shelf
OOC	Offshore Operators Committee
PAH	Polynuclear Aromatic Hydrocarbons
RPE	Reverse Phase Extraction
SBMs	Synthetic-based drilling muds
SGR	State game refuge
SGS	State game sanctuary
SPP	Suspended particulate phase
TAH	Total Aromatic Hydrocarbons
TAqH	Total Aqueous Hydrocarbons
TSS	Total Suspended Solids
WET	whole-effluent toxicity
WQBEL	water quality-based effluent limitation

1.0 INTRODUCTION

This assessment of Essential Fish Habitat (EFH) is for the issuance of a general National Pollutant Discharge Elimination System (NPDES) permit for oil and gas exploration, development, and production facilities in Cook Inlet, Alaska. The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established the procedures designated to identify, conserve, and enhance EFH; that is, essential habitat for species regulated under a federal fisheries management plan (FMP). The act requires federal agencies to consult with National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) on all actions, or proposed actions, authorized, funded, or undertaken by the agency that might adversely affect EFH. This document provides details suitable for an EFH assessment from the considered U.S. Environmental Protection Agency (EPA) actions related to the proposed project.

An EFH assessment must include (1) a description of the proposed action, (2) an analysis of the effects, (3) the federal agency's (in this case, EPA's) view of the effects of the action, and (4) mitigation, if necessary. To satisfy these requirements EPA includes the following sections:

- A description of the proposed actions including facilities, authorized activities, and monitoring requirements of the NPDES permit
- List of EFH of species and life history stages that may be affected by the project
- EPA's assessment of the effects of the action
- Mitigative actions being proposed
- Concluding EPA's EFH effects determination

2.0 PROPOSED ACTION

The federal action that is the subject of this EFH Assessment is the issuance of a general NPDES permit for oil and gas exploration, development, and production facilities in Cook Inlet, Alaska. This section of the EFH describes the geographical area (project area) covered by the permit, as well as the operations and discharges that would be authorized under the permit.

2.1 Description of Project Area

2.1.1 General

The expired general permit authorized discharges from exploratory oil and gas extraction facilities in Cook Inlet north of a line extending between Cape Douglas (58°13′ N latitude, 153°15′ W longitude) and Port Chatham (59°13′ N latitude, 151°47′ W longitude) (Figure 1-1). Development and production facilities were authorized to discharge only in the northern (coastal) portion of this area of coverage. This is the area north of a line extending across the Inlet at the southern edge of Kalgin Island (Figure 1-1).

The project area of coverage for the reissued general permit would include the areas covered by the expired permit (Figure 1-1) and an additional area to the south in the lower portion of Cook Inlet to the northern edge of Shuyak Island (Figure 1-2). The expanded area of coverage includes areas under Minerals Management Service lease sales 191 and 199 and the adjoining state waters (Figure 1-2).

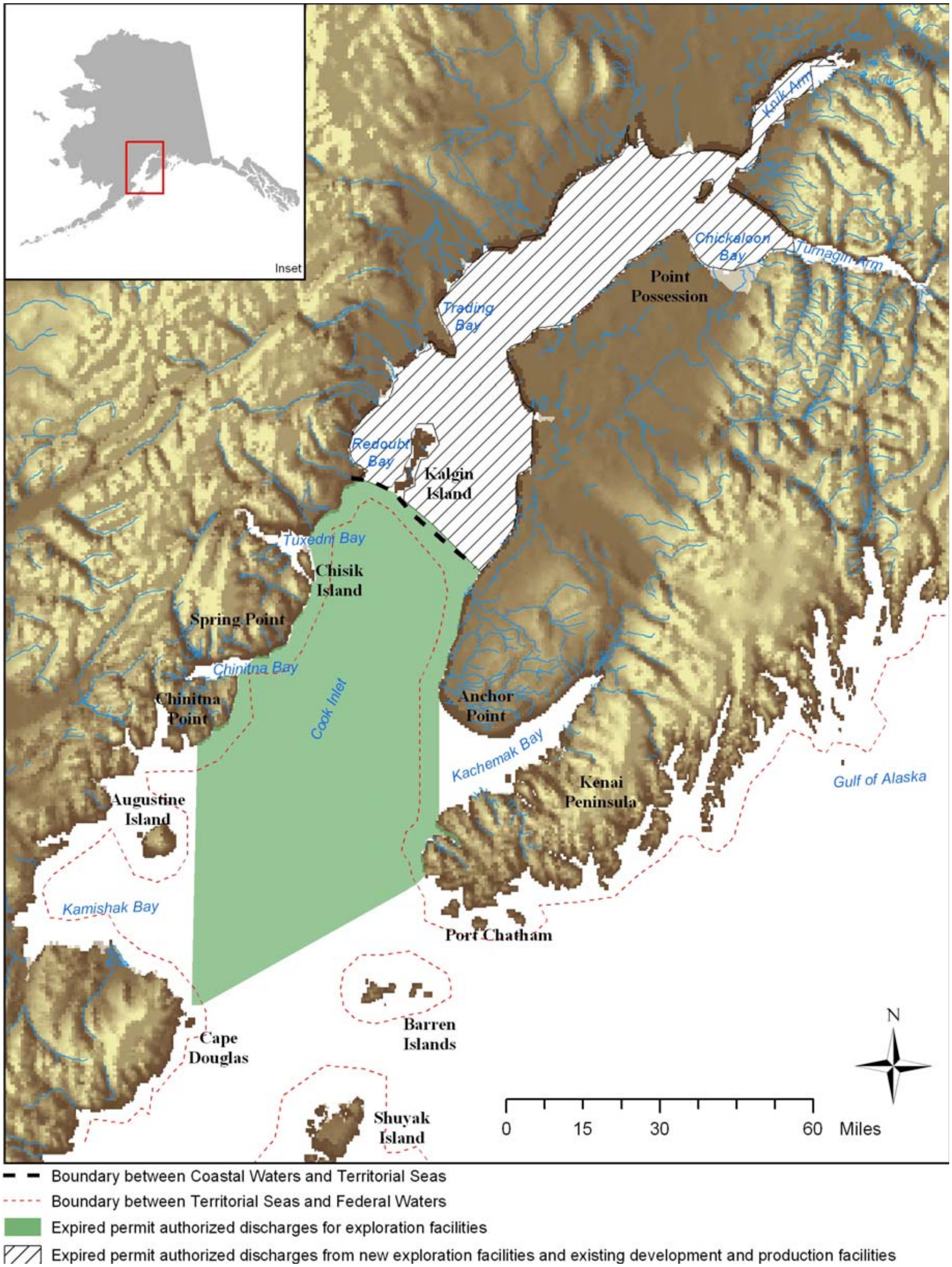
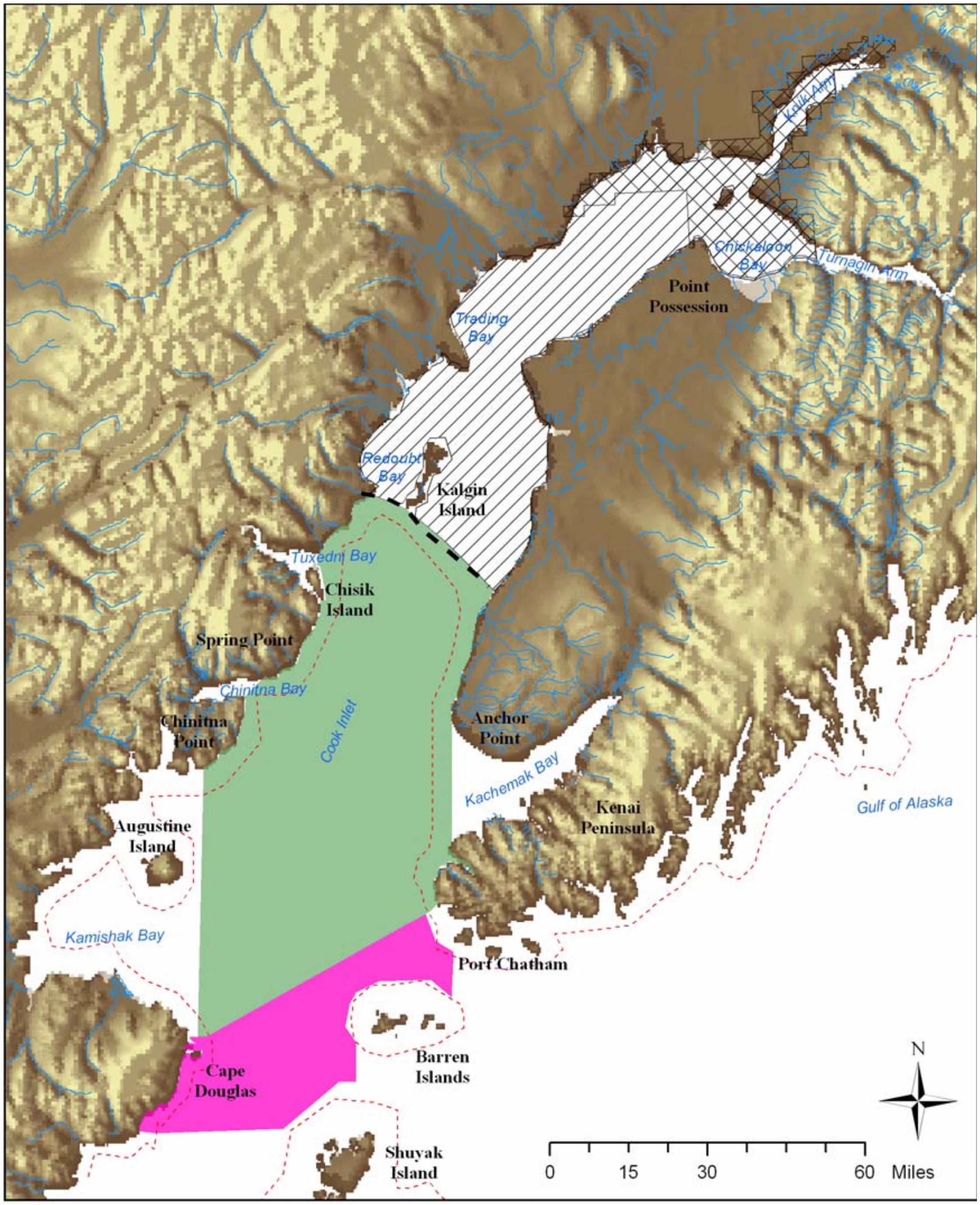


Figure 1-1. Expired NPDES permit areas.



Surface Access Restrictions

Boundary between Coastal Waters and Territorial Seas

Boundary between Territorial Seas and Federal Waters

General permit will authorize discharges from exploration facilities and new source development and production facilities

General permit will authorize discharges from exploration facilities and existing development and production facilities

Proposed New Area of Coverage for which the general permit will authorize discharges from exploration facilities and new source development and production facilities.

Figure 1-2. Proposed NPDES permit areas.

2.1.2 Discharge-Restricted Areas

The proposed general permit would contain restrictions and requirements to ensure that unreasonable degradation, as defined by the Ocean Discharge Criteria (40 CFR 125.121), would not occur. Restrictions and prohibited areas of discharge are listed below:

- No discharges in water depths less than 5 meters (mean lower low water [MLLW] isobath) for all facilities
- Exploration facilities are prohibited from discharging in waters less than the 10-meter MLLW isobath
- No discharges in Kamishak Bay west of a line from Cape Douglas to Chinitna Point
- No discharges in Chinitna Bay inside the line between the points of the shoreline at latitude 59°52′45″ N, longitude 152°48′18″ W on the north and latitude 59°46′12″ N, longitude 153°00′24″ W on the south
- No discharges in Tuxedni Bay inside of the lines on either side of Chisik Island
  - From latitude 60°04′06″ North, longitude 152°34′12″ W on the mainland to the southern tip of Chisik Island (latitude 60°05′45″N, longitude 152°33′30″ W)
  - From the point on the mainland at latitude 60°13′45″ N, longitude 152°32′42″ W to the point on the north side of Snug Harbor on Chisik Island (latitude 60°06′36″ N, longitude 152°32′54″ W)
- No discharges within 20 nautical miles of Sugarloaf Island, as measured from a center point at latitude 58°53′ N and longitude 152°02′ W;
- No discharges within the boundaries of, or within 4,000 meters of, a coastal marsh (the seaward edge of a coastal marsh being defined as the seaward edge of emergent wetland vegetation), river delta, river mouth designated as an Area Meriting Special Attention (AMSA), state game refuge (SGR), state game sanctuary (SGS), or critical habitat area (CHA). Areas meeting the above classifications within the proposed area of coverage are as follows;

Palmer Bay Flats SGR	Trading Bay SGR
Goose Bay SGR	Kalgin Island CHA
Potter Point SGR	Clam Gulch CHA
Susitna Flats SGR	Kachemak Bay CHA
McNeil River SGS	Anchorage Coastal Wildlife Refuge
Redoubt Bay CHA	Port Graham/Nanwalek AMSA
Lake Clark National Park	

- Mineral Management Service Lower Kenai Peninsula deferral area and Barren Island deferral area, including the area between the deferral areas and the shore.

- In Shelikof Strait, south of a line between Cape Douglas on the west (latitude 58°51′N, longitude 153°15′W) and the northernmost tip of Shuyak Island on the east (latitude 58°37′N, longitude 152°22′W)
- Prohibited tracts identified under the Alaska Department of Natural Resources (ADNR) Division of Oil and Gas's Mitigation Measure Number 33 (including the mouth of the Susitna River and Knik and Turnagin Arms).

2.2 Covered Facilities and Nature of Discharge

The federal action would authorize discharges from three types of facilities—exploration, development, and production. Each type of facility is briefly described below.

2.2.1 Exploration Facilities

Exploration for hydrocarbon-bearing strata can involve indirect methods, such as geological and geophysical surveys; however, direct exploratory drilling is the only method to confirm the presence and determine the quantity of hydrocarbons that might be present. Jackup rigs, which are barge-mounted drilling rigs with extendable legs that can be used in waters up to 300 feet deep, and semisubmersible units are the most common exploratory drilling facilities likely to be used in Cook Inlet (MMS 2003; USEPA 1996). Shallow exploratory wells are typically drilled in the initial phase of exploration to discover the presence of oil and gas reservoirs; deep exploratory wells are usually drilled to establish the extent of the reservoirs (USEPA 1996). The major waste streams discharged from exploratory facilities are drilling fluids, drill cuttings, cooling water, sanitary and domestic wastewater, and deck drainage. Exploratory wells are not expected to extract hydrocarbons and therefore have not been authorized for the discharge of produced waters.

The Minerals Management Service (MMS) estimated that exploratory well depths in the southern portion of the Cook Inlet outer continental shelf would average 6,000 feet and that each well would generate approximately 150 dry tons of drilling fluids and approximately 440 dry tons of drill cuttings for disposal (MMS, 2003). Exploratory operations were limited to a maximum of five wells per site under the expired NPDES general permit.

2.2.2 Development Facilities

Development of oil and gas reservoirs requires the drilling of wells into the reservoirs to begin hydrocarbon extraction, increase hydrocarbon production, or replace wells that are not producing on existing production sites (USEPA 1996). Operations are conducted from fixed or mobile facilities. Development wells tend to be smaller in diameter than exploratory wells because the information gained from exploratory drilling allows the driller to anticipate difficulties associated with the geological and geophysical properties of the subsurface strata. Development operations may occur prior to, or simultaneously with, production operations. The waste streams discharged from development operations include those generally discharged from exploratory facilities (drilling fluids, drill cuttings, cooling water, sanitary and domestic waste water, and deck drainage), but they can also include produced water.

MMS (2003) estimated that development and production well depths in the southern portion of the Cook Inlet outer continental shelf would average 7,500 feet and that each well would require approximately 75 dry tons of drilling fluids and generate approximately 550 dry tons of drill cuttings for disposal.

2.2.3 Production Facilities

Production operations consist of the active recovery of hydrocarbons from producing reservoirs. Facilities conducting production operations usually are not involved in exploration activities. These facilities typically discharge cooling water, sanitary and domestic wastewater, deck drainage, and produced water.

2.2.4 Existing Facilities

Eighteen facilities were active during the 5-year period from 1998 through 2003 and subject to the expired NPDES general permit within the area of coverage in Cook Inlet, Alaska (Table 2-1). Other facilities that were covered by that permit included three exploratory drilling wells (Fire Island, Sturgeon, and Sunfish), Steelhead blowout relief well, and North Forelands.

Table 2-1. Cook Inlet, Alaska NPDES General Permit No. AKG285000 Active Facilities

NPDES permit no.	Facility name	Operator
AKG285001	Granite Point Treatment Facility	Unocal
AKG285002	Trading Bay Treatment Facility	Unocal
AKG285003	East Foreland Treatment Facility	XTO Energy
AKG285004	Platform Anna	Unocal
AKG285005	Platform Baker	Unocal
AKG285006	Platform Bruce	Unocal
AKG285007	Platform Dillon	Unocal
AKG285008	King Salmon Platform	Unocal
AKG285009	Dolly Varden Platform	Unocal
AKG2850010	Spark Platform	Marathon
AKG2850011	Platform A (Tyonek Platform)	Phillips
AKG2850012	Cross Timbers Platform A	XTO Energy
AKG2850013	Cross Timbers Platform C	XTO Energy
AKG2850014	Spurr Platform	Unocal
AKG2850015	Granite Point Platform	Unocal
AKG2850016	Grayling Platform	Unocal
AKG2850017	Monopod Platform	Unocal
AKG2850019	Steelhead Platform	Unocal

Oil and gas are extracted from numerous wells associated with production and development platforms. Oil is generally produced in emulsion with water and must be separated from the water. Gas is generally produced with significantly less water than is associated with oil production. Oil and gas are separated from the produced water in various ways. Some production platforms are equipped to separate oil and gas from produced water onboard and discharge produced water directly to Cook Inlet. Other production platforms perform initial oil/water separation and then route their produced water to onshore facilities (Granite Point, Trading Bay, and East Foreland) for further treatment. In such cases, produced water is discharged from the onshore facility. Under the expired NPDES general permit, produced water is an authorized discharge from the following facilities: Granite Point Treatment Facility; Trading Bay Facility; East Forelands Treatment Facility; and platforms Anna, Baker, Bruce, Platform A (Tyonek), Cross Timbers Platform A, Cross Timbers Platform C, and Spark.

Occasionally, operators might decide to stop platform operations, ceasing production and subsequent discharges for some time. These facilities may resume production and discharging during the effective period of the permit. At this time, the platforms Baker, Dillon, Spurr, and Spark have ceased operations and, with the exception of deck drainage, are not discharging.

2.3 Authorized Action Under General NPDES Permit

Requirements and activities that would be authorized under the proposed general permit include technology-based permit requirements, water quality-based permit limits, and monitoring requirements

2.3.1 Technology-Based Permit Requirements

Technology-based limitations and conditions are proposed in the general permit as required under federal regulation (Effluent Limitations Guidelines, 40 CFR Part 435, Subparts A and D). These guidelines establish best practicable control technology (BPT), best conventional pollution control technology (BCT), best available pollution control technology economically achievable (BAT), and new source performance standards (NSPS) for the offshore and coastal subcategories of the oil and gas extraction point source category. The limitations and monitoring requirements for the individual waste streams that would be authorized by the general permit are described below.

2.3.1.1 Drilling Fluids

Drilling fluids are complex mixtures of clays, barite, and specialty additives used primarily to remove rock particles (cuttings) from the hole created by the drill bit and transport them to the surface. Other functions include cooling and lubricating the drill bit and controlling formation pressures. As the hole becomes deeper and encounters different geological formations, the type of mud, or the mud composition, might need to be changed to improve drilling performance.

The technology-based limits for drilling fluids in the expired general permit would be included in the reissued permit. Discharges of drilling fluids from new source facilities would not be authorized.

Federal guidelines for the discharge of drilling fluids in offshore and coastal waters establish limits that must not be exceeded throughout Cook Inlet. Based on those guidelines, limits and prohibitions for the proposed general permit include the following:

- No discharge of free oil.
- No discharge of diesel oil, and a minimum toxicity limit of 3 percent by volume.
- Cadmium and mercury in stock barite, which is added to drilling fluids, limited to 3 mg/kg and 1 mg/kg, respectively.
- No discharge of nonaqueous-based drilling fluids, also known as synthetic-based drilling fluids, except those which adhere to drill cuttings as described in section 2.3.1.2.
- No discharge of oil-based drilling fluids, inverse emulsion drilling fluids, oil-contaminated drilling fluids, and drilling fluids to which mineral oil has been added.

Free oil in drilling mud discharges is to be measured using the static sheen test method. Toxicity is measured with a 96-hour LC_{50} (concentrations lethal to 50 percent of the test organisms) on the suspended particulate phase using the *Leptachoirus plumniosus* species. Cadmium and mercury are measured using USEPA Method 245.5 or 7471 on the stock barite prior to adding it to drilling fluids. These BAT- and NSPS-based limits apply to drilling mud discharges throughout the area of coverage of the proposed general permit.

2.3.1.2 Drill Cuttings

Drill cuttings are the waste rock particles brought up from the well hole during exploratory drilling operations. During typical operations, a mixture of cuttings and drilling mud returns to the surface between the drill pipe and the bore hole. At the surface the cuttings and mud are separated, and the cuttings are saved for analysis or disposed of by discharge into adjacent waters. The main source of pollutants in drill cuttings are associated with the drilling fluids that adhere to the rock particles.

The technology-based limits in the expired general permit for drill cuttings for exploratory facilities would be included without modification in the reissued general permit. No discharge of cuttings would be authorized for new development and production facilities.

The limits and prohibitions proposed for the general permit include:

- No discharge of free oil associated with cuttings discharges.
- No discharge of drill cuttings generated using drilling fluids that are contaminated by oil or contain diesel oil or mineral oil.
- Cadmium and mercury in stock barite, which is added to drilling fluids, are limited to 3 mg/kg and 1 mg/kg, respectively.
- The toxicity of the suspended-particulate phase of drilling fluids is limited to 30,000 ppm.

Although the discharge of nonaqueous-based drilling fluids would be prohibited under the proposed permit (see Section 2.3.1.1), the discharge of drill cuttings that are generated using nonaqueous-based drilling fluids is proposed to be authorized by the reissued permit. These new discharges are proposed to be authorized only in the territorial seas and federal waters in Cook Inlet. Nonaqueous-based drilling fluids, also known as synthetic-based muds, are a pollution prevention technology because the drilling fluids are not disposed of through bulk discharge at the end of drilling. Instead, the drilling fluids are brought back to shore and refurbished so that they can be reused. Drilling with synthetic-based muds allows an operator to drill a slimmer well and causes less erosion of the well during drilling than drilling using water-based muds. Therefore, relative to drilling with water-based muds, the volume of drill cuttings discharged is reduced.

The limitations on the discharge of nonaqueous-based drilling fluids associated with cuttings are based on the Effluent Limitations Guidelines for the Oil and Gas Extraction Point Source Category (see 40 CFR Part 435, Subpart B). New limits are proposed for both the stock synthetic base muds that are added to drilling fluids and the drilling fluids that adhere to discharged drill cuttings. The limits proposed to be applied to stock base muds include polynuclear aromatic hydrocarbons (PAHs), sediment toxicity (10-day), and the biodegradation rate. Prior to use, the drilling mud is also limited for formation oil contamination, measured using gas chromatography/mass spectrometry (GC/MS). Drilling fluids that adhere to drill cuttings and are discharged are limited for sediment toxicity (4-day), formation oil contamination as measured by a reverse-phase extraction test or GC/MS, and base fluids that are retained on discharged drill cuttings.

2.3.1.3 Produced Water

The term *produced water* refers to the water brought up from the oil-bearing subsurface geologic formations during oil and gas extraction; it can include formation water, injection water, and any chemicals added to the well hole or added during the oil/water separation process (USEPA 1996).

All the existing development and production facilities in Cook Inlet are in coastal waters in the area north of a line extending across Cook Inlet at the southern edge of Kalgin Island (Figure 1-1). Federal guidelines for the coastal subcategory of the oil and gas extraction point source category allow produced waters to be discharged to Cook Inlet coastal waters provided the discharges meet a monthly average oil and grease limit of 29 mg/L and a daily maximum oil and grease limit of 42 mg/L. These limits are contained in the expired general permit for produced water and would be included without modification, for existing facilities only, in the reissued general permit.

Produced waters would not be authorized for discharge in either coastal or offshore waters for new sources. Federal regulations define the term *new source* for the oil and gas extraction point source category (61 FR 66125, December 16, 1996). In simple terms, a *new source* with respect to produced waters is a development/production facility, or an onshore treatment facility, that was constructed after EPA issued the New Source Performance Standards.

The proposed general permit would include a new produced water sheen monitoring requirement that was not part of the expired general permit. Under this requirement, operators of existing facilities would observe the receiving water down-current of the produced water discharge once a day to see if there is a visible sheen. If a sheen is observed, the operators would then be required to collect and analyze a produced water sample to ensure compliance with the oil and grease limit. Observations would be required to be made during slack tide so that the turbulence that can be present during periods of high ambient velocity would not interfere with the ability to see a sheen. Observation of a sheen would not be required at times when conditions such as sea ice make it difficult to see a sheen.

2.3.1.4 Produced Sand

The term *produced sand* refers to slurried particles that are the accumulated formation sands and scale particles generated during oil and gas production (USEPA 1996). It also includes de-sander discharge from the produced water waste stream and blowdown of the water phase from the produced water treating system.

The expired general permit prohibited the discharge of produced sand based on NSPS, BAT, and BCT established by the Offshore Subcategory Effluent Limitations Guidelines. This restriction would be included without modification in the reissued general permit.

2.3.1.5 Well Treatment, Completion and Workover Fluids

The term *well treatment fluids* refers to any fluid used to restore or improve the productivity of a well by chemically or physically altering the oil-bearing subsurface geologic formations (strata) after a well has been drilled (USEPA 1996). *Well completion fluids* are salt solutions, weighted brines, polymers, and various additives used to prevent damage to the well bore during operations that prepare the drilled well for hydrocarbon production (USEPA 1996). *Workover fluids* are salt solutions, weighted brines, polymers, or other specialty additives used in a producing well to allow safe repair and maintenance or abandonment procedures (USEPA 1996).

The federal guidelines for NSPS and BAT (40 CFR 435.15) for the offshore category of the oil and gas extraction point sources require monthly average oil and grease limits of 29 mg/L and a daily maximum oil and grease limit of 42 mg/L for well treatment, well completion, and workover fluids. A limit of no free oil discharge is also required for these discharge categories. These limits for produced water are contained in the expired general permit and would be included without modification in the reissued general permit.

2.3.1.6 Deck Drainage

The term *deck drainage* refers to any waste resulting from deck washings, spillage, rainwater, and runoff from gutters and drains, drip pans, and work areas (USEPA 1996). Federal guidelines for NSPS, BAT, and BCT for the offshore and coastal subcategories of the oil and gas extraction point source category require no discharge of free oil for this discharge category. The proposed general permit would also include new requirements for stormwater discharges for the existing onshore production facilities. (See Section 2.2.3.11 for the stormwater discharge requirements).

2.3.1.7 Sanitary Waste

The term *sanitary waste* refers to human body waste discharged from toilets and urinals within facilities subject to the general permit (USEPA 1996).

The federal guidelines for NSPS and BCT for the offshore and coastal subcategories of oil and gas extraction point sources require that residual chlorine be maintained as close to 1 mg/L as possible for facilities continuously staffed by 10 or more persons. The NSPS and BCT guidelines also require no discharge of floating solids for offshore facilities continuously staffed by nine or fewer persons or intermittently staffed by any number of persons.

The expired general permit specified a maximum total residual chlorine limit of 19 mg/L and a minimum requirement of 1 mg/L. The proposed general permit would specify a lower maximum Total Residual Chlorine limit of 2 mg/L and maintain the existing minimum requirement of 1 mg/L for facilities located in territorial seas. The proposed general permit will specify a maximum Total Residual Chlorine limit of 13.5 mg/l and a minimum of 1mg/l for facilities in coastal waters.

The expired general permit also included water quality-based limits for biochemical oxygen demand (BOD), and total suspended solids (TSS). The proposed general permit would maintain the existing effluent limitations for BOD (average monthly limit of 30 mg/L; daily maximum limit of 60 mg/L) and TSS (average monthly limit of 51 mg/L; daily maximum limit of 67 mg/L).

2.3.1.8 Domestic Waste

The term *domestic waste* refers to materials discharged from sinks, showers, laundries, safety showers, eyewash stations, and galleys within facilities subject to the general permit (USEPA 1996).

The federal guidelines for NSPS, BAT, and BCT for the offshore and coastal subcategories of oil and gas extraction point sources require no discharge of floating solids or foam for this discharge category. This limit is contained in the expired general permit and would be included without modification in the reissued general permit.

2.3.1.9 Miscellaneous Discharges

Miscellaneous discharges that were authorized by the expired general permit include desalination wastewater, blowout preventer fluid, boiler blowdown, fire control system test water, non-contact cooling water, uncontaminated ballast water, bilge water, excess cement slurry, muds, cuttings, and cement at the seafloor, and water-flooding wastewater. Brief definitions (USEPA 1996; 63 FR 211) of these discharges are provided below:

- desalination wastewater — wastewater associated with the process of creating fresh water from sea water.
- blowout preventer fluid — hydraulic fluid used in blowout preventer stacks during well drilling.
- boiler blowdown — discharges from boilers necessary to minimize solids buildup in the boilers.
- fire control system test water — sea water that is sometimes treated with biocide, used for the fire control system on oil and gas platforms and other facilities.
- non-contact cooling water — sea water that is sometimes treated with biocide, used for non-contact, once-through cooling of crude oil, produced water, power generators, and various other pieces of machinery.
- uncontaminated ballast water — tanker or platform ballast water, either local sea water or fresh water, from the location where the ballast water was pumped into the vessel.
- bilge water — seawater that becomes contaminated with oil and grease and solids such as rust when it collects at low points in the bilges.
- excess cement slurry — excess mixed cement, including additives and waste from equipment washdown, after a cementing operation.
- Water-flooding discharges — discharges associated with the treatment of sea water prior to its injection into a hydrocarbon-bearing formation to improve the flow of hydrocarbons from production wells.

The expired general permit limited these miscellaneous discharges by requiring no free oil discharges, as monitored by the visual sheen test method. The permit required that discharges of uncontaminated ballast water and bilge water be treated in an oil-water separator. Bilge water discharges were required to be sampled for free oil using the static sheen test method when discharges occurred during broken, unstable, or stable ice conditions. The proposed general permit contains a new sheen monitoring requirement for produced water discharges. The proposed general permit does not require the use of the static sheen method during times when storms or ice make observation of a sheen difficult. NPDES permittees were also required to maintain a precise inventory of the types and quantities of chemicals added to water flood, non-contact cooling water, and desalinization wastewater discharges.

Federal guidelines for the offshore and coastal subcategories of oil and gas extraction point sources for this discharge category are not available. The limitations and monitoring requirements described above for the expired general permit are proposed to be included without modification, except as described below in Section 2.3.1.10, in the reissued general permit.

2.3.1.10 Chemically Treated Seawater Discharges

A broad range of chemicals are used to treat sea water and fresh water in offshore oil and gas operations; the available literature shows that more than 20 biocides are commonly used. They include derivatives of aldehydes, formaldehyde, amine salt, and other compounds. The toxicity of those compounds to marine organisms, as measured with a 96-hour LC_{50} test, varies substantially (0.4 mg/L to greater than 1,000 mg/L). The scale inhibitors commonly used are amine phosphate ester and phosphonate compounds. Scale inhibitors are generally less toxic to marine life than are biocides; 96-hour LC_{50} concentrations for scale inhibitors have been shown to range from 1,676 mg/L to greater than 10,000 mg/L. Corrosion inhibitors are generally more toxic to marine life; 96-hour LC_{50} values for corrosion inhibitors are reported to range from 1.98 mg/L to 1,050 mg/L.

The discharge of specific biocides, scale inhibitors, and corrosion inhibitors is not proposed to be limited in the reissued general permit. Because of the large number of chemical additives used, it would be very difficult to develop technology-based limits for each individual additive. Also, if the permit were to limit specific chemicals, it could potentially halt the development and use of new and potentially more beneficial treatment chemicals, which would not be specifically listed in the permit and for which discharge would not be authorized. An additional reason for not specifying chemical additives is that the field conditions for each producing well can change and require different treatment over the life of the permit. Instead, chemically treated sea water discharges would be limited on the basis of the following requirements:

- The concentrations of treatment chemicals in discharges of sea water or fresh water would be limited to the most stringent of the following: (1) the maximum concentrations and any other conditions specified in the EPA product registration labeling if the chemical additive is an EPA-registered product, (2) the maximum manufacturer's recommended concentration when one exists, or (3) a maximum of 500 mg/L.

2.3.1.11 Stormwater Runoff from Onshore Facilities

The proposed general permit would include new requirements for existing onshore production facilities. The operators of the onshore facilities would be required to develop and implement Storm Water Pollution Prevention Plans. The plans would include management practices implemented to monitor and maintain operations to prevent contamination of stormwater. The change in requirements would ensure greater consistency between the stormwater requirements of onshore production facilities and those typically required for shore-based industrial facilities.

2.3.1.12 All Discharges

The proposed general permit would prohibit the discharge of rubbish, trash, and other refuse. It would also require that the discharge of surfactants, dispersants, and detergents be minimized.

2.3.2 Water Quality-Based Permit Requirements

The proposed general permit establishes water quality based limitations and monitoring requirements necessary to ensure that the authorized discharges comply with Alaska's Water Quality Standards and with the federal Ocean Discharge Criteria (40 CFR Part 125, Subpart M, and section 403 of the Clean Water Act).

2.3.2.1 Alaska State Water Quality Standards

Section 301(b)(2)(C) of the Clean Water Act and 40 CFR 122.44(d)(1) require that NPDES permits contain the limitations and conditions necessary to attain state Water Quality Standards. The expired general permit contained limits based on state Water Quality Standards for metals, hydrocarbons, and toxicity in produced water discharges. On the basis of updated mixing zone computations described below, the expired permit's Water Quality Standards-based limitations are proposed to be recalculated. In addition, new limits for whole-effluent toxicity on miscellaneous discharges to which treatment chemicals have been added are proposed. The industry uses treatment chemicals such as biocides, corrosion inhibitors, and oxygen scavengers in a number of discharges such as cooling water and water flood waste water. Many of those chemical additives have been shown to be highly toxic. To ensure that such discharges comply with the requirements of both state Water Quality Standards and federal Ocean Discharge Criteria, whole effluent toxicity limitations are included in the proposed general permit.

EPA and states establish mixing zones to minimize the portion of a waterbody in which water quality criteria are exceeded. In state waters, states typically have the authority to define mixing zones and determine their size. Chronic aquatic life and human health criteria are limited on the basis of the calculated critical dilution at the edge of the mixing zone. In general, criteria to protect aquatic life from acute toxic effects of discharges must be met at the edge of a smaller mixing zone called the zone of initial dilution. The zone of initial dilution is typically intended to further restrict the portion of the waterbody that is acutely toxic to aquatic life. Alaska's Water Quality Standards also specify that acute water quality criteria must be met at the edge of a smaller initial mixing zone (see 18 ACC 70.255(d)). Aquatic life would tend to pass through a smaller zone of initial dilution fairly rapidly and, because of the short exposure time, the acute toxic effects of the discharged pollutant would be minimized. Chronic aquatic life criteria and human health criteria are based on longer-term exposure of aquatic life to pollutants. Thus, mixing zones are larger than zones of initial dilution and allow for a longer exposure time.

Alaska's Water Quality Standards do not allow mixing zones to be used unless they are authorized by ADEC (Alaska Department of Environmental Conservation). When they are authorized, the standards require that they be as small as practicable (see 18 ACC 70.240). The state regulations at 18 AAC 70.245 require that in determining the appropriateness and size of a mixing zone, the existing uses of the waterbody must be fully protected and maintained. Numeric water quality criteria are used to measure the attainment of Water Quality Standards. Although the standards allow numeric criteria for chronic aquatic life and human health protection to be exceeded within the mixing zone, the criteria must be met at its boundary. The standards (18 AAC 70.255) also require that there be no lethality to organisms passing through mixing zones and that acute aquatic life criteria be met at the boundary of a smaller zone of initial dilution established within the mixing zone.

Alaska's Water Quality Standards do not allow ADEC to authorize mixing zones if the pollutants could bioaccumulate or persist in concentrations above natural levels in the environment or if they can be expected to cause a carcinogenic or other human health risk. ADEC is required to take the potential exposure pathways into account in determining whether to authorize mixing zones. ADEC has determined that the discharges authorized by the previous permit are not likely to persist in the environment and therefore has authorized mixing zones. The state has previously authorized mixing zones ranging in size from 363 meters to 1,420 meters from the discharge point for Cook Inlet oil and gas facilities.

On the basis of the maximum projected discharge rates and pollutant concentrations forecast by the permittees, ADEC has approved the new mixing zones. The new mixing zones radii and the previous mixing zone radii are shown in Table 2-2.

Table 2-2. Proposed and Previous Mixing Zone Radii (meters)

Facility	Total aromatic hydrocarbons (TAH)/ total aqueous hydrocarbons (TAqH)		Acute metals		Chronic metals		Whole-effluent toxicity	
	Proposed	Previous	Proposed	Previous	Proposed	Previous	Proposed	Previous
Granite Point (Onshore)	2,685	955	19	20	21	66	780	20
Trading Bay	2,418 [a]	1,420	<1 [b]	42	9 [c]	431	31 [d]	59
East Foreland	1,794	412	142	20	121	106	1,742	20
Tyonek A	36	20	36	20	60	663	73	46
Anna	2,734	363	239	20	262	37	274	40
Bruce	1,840	867	201	20	218	31	715	58
Baker	3,016	555	202	22	216	37	248	20
Dillon	2,121	405	11	20	13	43	210	20
Granite Point (Platform)	1,863	None	12	None	14	None	533	None

a Mixing zone will be 5,791 m initially. Unocal will reduce the mixing zone to 2,418 m by installing a diffuser on a two year compliance schedule.

b Mixing zone will be 124 initially. Unocal will reduce the mixing zone to <1 m by installing a diffuser on a two year compliance schedule.

c Mixing zone will be 760 initially. Unocal will reduce the mixing zone to 9 m by installing a diffuser on a two year compliance schedule.

d Mixing zone will be 804 initially. Unocal will reduce the mixing zone to 31 m by installing a diffuser on a two year compliance schedule.

The new mixing zones in the proposed general permit are in many cases larger than those previously authorized by ADEC. The main reasons for these larger mixing zones are that a more conservative model was used in the mixing zone applications for the proposed permit (CORMIX versus Plumes) and that mixing zones were established for reasonable worst-case conditions.

The proposed general permit includes a new requirement for a diffuser on the Trading Bay discharge. The Trading Bay discharge is significantly greater in volume than the other discharges that would be authorized under the general permit. The discharge is also located in fairly shallow water and is much nearer to sensitive areas than any other produced water discharge in Cook Inlet. Therefore, EPA has determined that additional controls are needed for the Trading Bay produced water discharge. By dividing the effluent and discharging it through a number of separate ports, a diffuser can greatly increase mixing. Through more efficient mixing, the size area of the mixing zone can be greatly reduced. The Trading Bay discharge was examined for a number of discharge velocities, diffuser lengths, and ambient current speeds to determine a diffuser design that is technically feasible and would result in the smallest mixing zone. As a result of coordinated efforts between ADEC, the Operator, and EPA, a diffuser has been designed for the Trading Bay discharge that would reduce the mixing zone length from 5,791 meters to 100 meters under most ambient current conditions. Under conditions representative of very low current speeds, the mixing zone with a diffuser would be 2,418 meters. Because mixing zones were established based on reasonable worst-case conditions, the mixing zone approved by ADEC for Trading Bay is 2,418 meters. This much smaller mixing zone would help to ensure that any potential effects from the discharge are greatly minimized. A compliance schedule is included in the proposed permit, and it affords the permittee 2 years to design, construct, and install the diffuser.

As noted, all mixing zones were derived using conditions representative of a reasonable worst-case scenario. ADEC used the CORMIX dispersion model to calculate the dilution the effluent plume receives and determine where the discharges would meet Water Quality Standards. The discharges were examined for a variety of conditions. The current speed at which the discharges were modeled was found to have the most significant effect on mixing. For a single-port discharge, the worst-case scenario was generally found to exist at high current speeds. The worst-case scenario for a discharge made through a multiple-port diffuser was found to exist at low current speeds. The difference between single-port discharges and diffusers is caused by changes in the receiving water dynamics created by the discharge made through a diffuser. A diffuser discharge is typically made at a high velocity through a number of ports. The diffuser line and the multiple discharges made from a diffuser cause localized instability of the currents. At high current speeds, that instability results in a very high degree of mixing relative to a discharge made through a single port. The mixing is less when current speeds are lower; however, better mixing at low current speeds can be achieved by increasing the diffuser length. For the Trading Bay discharge, a diffuser approximately 100 meters in length is planned. That diffuser would accommodate a high degree of mixing at both low and high current speeds.

The number of dilutions calculated for the different produced water discharges is shown in Table 2-3. The dilutions, calculated by CORMIX, were used to derive the numeric Water Quality Standards-based limits shown in Appendix A.

Table 2-3. ADEC Calculated Dilutions

Facility	TAH/TAqH		Acute metals		Chronic metals		Whole-effluent toxicity	
	Mixing zone (m)	Dilutions	Mixing zone (m)	Dilutions	Mixing zone (m)	Dilutions	Mixing zone (m)	Dilutions
Granite Point (Onshore)	2,685	7,756	19	32.2	21	35.9	780	1,638
Trading Bay	2,418 [a]	1,970	<1 [b]	20.3	9 [c]	183.3	14 [d]	346
East Foreland	1,794	2,556	142	64.6	121	55.1	1,742	1,476
Tyonek A	36	175.6	36	178.7	60	276.7	73	327
Anna	2,387	12,509	197	599.1	262	665.6	274	701
Bruce	1,447	9,170	130	496	218	550.7	715	2,625
Baker	3,016	15,668	202	151	216	168	248	210
Dillon	2,121	3,386	11	24	13	26	210	358
Granite Point (Platform)	1,863	7,756	130	32.2	14	35.9	533	1,638

a Mixing zone will be 5,791 initially. Unocal will reduce the mixing zone to 1,554 m by installing a diffuser on a two year compliance schedule.

b Mixing zone will be 124 initially. Unocal will reduce the mixing zone to 4 m by installing a diffuser on a two year compliance schedule.

c Mixing zone will be 988 initially. Unocal will reduce the mixing zone to 14 m by installing a diffuser on a two year compliance schedule.

d Mixing zone will be 83 initially. Unocal will reduce the mixing zone to <1 m by installing a diffuser on a two year compliance schedule.

In addition to the limits based on the current discharges, the proposed general permit would include incremental limits intended to accommodate future changes in the volume of produced-water discharges. The previous permit did not include incremental limits. Consequently, when the Trading Bay discharge increased from 2,742,660 gallons per day to 5,598,600 gallons per day, the assumptions made in deriving the Water Quality Standards-based limits were no longer valid. The incremental limits in the proposed permit were calculated using the range of discharge rates that could reasonably be expected for each discharge. The ranges of discharge rates were analyzed using CORMIX to determine the changes in flow that would significantly affect the dilution at the edge of the state-established mixing zones. The incremental ranges in the discharge volumes that were examined and the calculated dilutions are shown in Table 2-4.

Table 2-4. Incremental Discharges and the Associated Dilutions

GRANITE POINT

Discharge rate (gpd)	Dilutions at TAH/TAqH mixing zone (2,685 meters)	Dilutions at acute metals mixing zone (19 meters)	Dilutions at chronic metals mixing zone (21 meters)	Dilutions at whole-effluent toxicity mixing zone (780 meters)	Dilutions at ammonia mixing zone (53 meters)
7,000	7,756	32.2	35.9	1,638	90
10,000	15,158	79	136	3,235	117.4
15,000	13,227	68	118	2,821	102.1
20,000	12,005	62	107	2,558	91.7
30,000	10,521	54	93	2,237	80.7

TRADING BAY

Discharge rate (gpd)	Dilutions at TAH/TAqH mixing zone (2,418 meters)	Dilutions at acute metals mixing zone (1 meters)	Dilutions at chronic metals mixing zone (9 meters)	Dilutions at whole-effluent toxicity mixing zone (31 meters)	Dilutions at ammonia mixing zone (1 meters)
5,000,000	2,181	20.3	183.3	346	72
5,600,000	1,970	20.3	183.3	346	72
6,000,000	1,850	20.3	183.3	346	72
7,000,000	1,619	20.3	183.3	346	72

EAST FORELAND

Discharge rate (gpd)	Dilutions at TAH/TAqH mixing zone (1,794 meters)	Dilutions at acute metals mixing zone (142 meters)	Dilutions at chronic metals mixing zone (121 meters)	Dilutions at whole-effluent toxicity mixing zone (1,742 meters)	Dilutions at ammonia mixing zone (21 meters)
200,000	1,812	107	129	1,748	1
500,000	1,365	77	93	1,277	1
700,000	2331	70	85	1,152	1
840,000	2,556	64.6	55.1	1,476	1

PLATFORM ANNA

Discharge rate (gpd)	Dilutions at TAH/TAqH mixing zone (2,734 meters)	Dilutions at acute metals mixing zone (239 meters)	Dilutions at chronic metals mixing zone (262 meters)	Dilutions at whole-effluent toxicity mixing zone (274 meters)	Dilutions at ammonia mixing zone (81 meters)
25,000	15,584	752	839	874	291
51,000	12,509	599.1	665.6	701	234
75,000	10,886	506	564	587	194
100,000	9,794	439	491	512	166

Table 2-4. Incremental Discharges and the Associated Dilutions (continued)

PLATFORM BRUCE					
Discharge rate (gpd)	**Dilutions at TAH/TAqH mixing zone (1,840 meters)**	**Dilutions at acute metals mixing zone (201 meters)**	**Dilutions at chronic metals mixing zone (218 meters)**	**Dilutions at whole-effluent toxicity mixing zone (715 meters)**	**Dilutions at ammonia mixing zone (29 meters)**
5,000	12,138	660	728	3,846	128
11,500	9,170	496	550.7	2,625	108
15,000	8,217	411	456	2,306	73
20,000	7,232	318	357	1,964	48
TYONEK A					
Discharge rate (gpd)	**Dilutions at TAH/TAqH mixing zone (36 meters)**	**Dilutions at acute metals mixing zone (36 meters)**	**Dilutions at chronic metals mixing zone (60 meters)**	**Dilutions at whole-effluent toxicity mixing zone (73 meters)**	**Dilutions at ammonia mixing zone (4 meters)**
25,000	166	166	267	324	0
31,066	175.2	175.2	274.5	323.5	0
40,000	164	164	251	300	0

2.3.3 Monitoring Requirements

Monitoring requirements for authorized discharge categories are described below.

2.3.3.1 Drilling Fluids and Drill Cuttings

The monitoring requirements for the discharge of drilling fluids and drill cuttings for the proposed general permit are specified in Table 2-5.

In addition to the requirements shown in Table 2-5, the permittee must maintain a precise chemical inventory of all constituents added down hole, including all drilling mud additives used to meet specific drilling requirements. The permittee must maintain these records for each mud system for 5 years and must make the records available to EPA upon request.

2.3.3.2 Deck Drainage and Stormwater Runoff

The monitoring requirements for the discharge of deck drainage and stormwater for the proposed general permit are shown in Table 2-6. In addition, operators of shore-based facilities must comply with Storm Water Pollution Prevention Plan requirements. The free oil limits and toxicity testing requirements are not proposed to be changed from those in the expired permit.

The permittee must ensure that deck drainage contaminated with oil and grease is processed through an oil-water separator prior to discharge. Once per discharge event, the permittee must sample deck drainage discharges that are processed through the oil-water separator and test for sheen, total aromatic hydrocarbons, total aqueous hydrocarbons, and PAHs.

Table 2-5. Effluent Limitations and Monitoring Requirements for Drilling Fluids and Drill Cuttings (Discharge 001)

Discharge	Pollutant parameter	Effluent limitation		Monitoring requirements	
		Average monthly limit	Maximum daily limit	Measurement frequency	Sample type
Water-based muds and cuttings	Suspended particulate phase toxicity [a]	Minimum 96-hour LC_{50} of 30,000 ppm		Monthly and end-of-well	Grab
	Drilling fluids	No discharge [b]		Daily	Grab
	Free oil	No discharge [c, d]		Daily	Visual
	Diesel oil	No discharge		Daily	Grab
	Mercury	1 mg/kg [e]		Once per well	Grab
	Cadmium	3 mg/kg [e]		Once per well	Grab
	Total Volume [b]	See II.B.6		Monthly	Estimate
	Depth-dependent discharge rate [c] 0 to 5 meters >5 to 20 meters >20 to 40 meters >40 meters	No discharge 500 bbl/hr 750 bbl/hr 1,000 bbl/hr		Continuous during discharge	Estimate
Nonaqueous muds	Drilling fluids	No discharge		Daily	Observation
Nonaqueous stock base mud (C_{16}-C_{18} internal olefin, C_{12}-C_{14} ester or C_8 ester)	Mercury	1 mg/kg [e]		Annual	Grab
	Cadmium	3 mg/kg [e]		Annual	Grab
	PAH [f]	mass ratio [g] $<1 \times 10^{-5}$		Annual	Grab
	Sediment toxicity	ratio [h] <1.0		Annual	Grab
	Biodegradation rate	ratio [i] <1.0		Annual	Grab
	Total volume	See II.B.6		Monthly	Estimate
Nonaqueous drilling fluids which adhere to drill cuttings (offshore subcategory only)	Free oil	No discharge [c, d]		Daily	Grab
	Diesel oil	No discharge		Daily	Grab
	SPP toxicity [a]	Minimum 96-hour LC_{50} of 30,000 ppm		Monthly	Grab
	Sediment toxicity	Drilling mud sediment toxicity ratio [j] <1.0		Annual	Grab
	Formation oil	No discharge [k]		Daily	Grab
	Base mud retained on drill cuttings (C_{16}-C_{18} internal olefin stock [l])	6.9 g NAF base mud/100 g wet drill cuttings [m]		Daily [o]	Grab
	Base mud retained on drill cuttings [n] (C_{12}-C_{14} ester or C_8 ester stock)	9.4 g NAF base mud/100 g wet drill cuttings [m]		Daily [o]	Grab
	Total volume	See II.B.6		Monthly	Estimate

Table 2-5. Effluent Limitations and Monitoring Requirements for Drilling fluids and Drill Cuttings (Discharge 001) (continued)

[a] As determined by the 96-hour suspended particulate phase (SPP) toxicity test. See 40 CFR Part 435, Subpart A, Appendix 1.

[b] Report total volumes for all types of operations (exploratory, production and development). See part II.B.3 of this permit.

[c] Maximum flow rate of total muds and cuttings includes pre-dilutant water; water depths are measured from mean lower low water.

[d] As determined by the static sheen test. (See Appendix 1 to 40 CFR part 435, subpart A.)

[e] Dry weight in the stock barite. Analysis shall be conducted using EPA Methods 245.5 or 7471. The permittee shall analyze a representative sample of stock barite once prior to drilling each well and submit the results with the Discharge Monitoring Report (DMR) for the month in which drilling operations commence for the respective well. If the permittee uses the same supply of stock barite to drill subsequent wells, the permittee may submit the same analysis for those subsequent wells.

[f] Polynuclear aromatic hydrocarbons.

[g] PAH mass ratio = [mass (g) of PAH (as phenanthrene)] ÷ [mass (g) of stock base mud] as determined by EPA method 1654, Revision A, entitled "PAH Content of Oil by HPLC/UV," December 1992. See part II.I.4. of this permit.

[h] Base mud sediment toxicity ratio = [10-day LC_{50} of C_{16}-C_{18} internal olefin, C_{12}-C_{14} ester or C_8 ester] ÷ [10-day LC_{50} of stock base mud] as determined by ASTM E 1367-92 method: "Standard Guide for Conducting 10-day Static Sediment Toxicity Tests with Marine and Estuarine Amphipods,"1992, after preparing the sediment according to the method specified at 40 CFR Part 435, Subpart A, Appendix 3. See part II.I.2 of this permit.

[i] Biodegradation rate ratio = [cumulative gas production (ml) of C_{16}-C_{18} internal olefin, C_{12}-C_{14} ester or C_8 ester] ÷ [cumulative gas production (mL) of stock base mud], both at 275 days as determined by ISO 11734:1995 method: "Water quality - Evaluation of the 'ultimate' anaerobic biodegradability of organic compounds in digested sludge--Method by measurement of the biogas production (1995 edition)" as modified for the marine environment. See part II.I.3 of this permit.

[j] Drilling mud sediment toxicity ratio = [4-day LC_{50} of C_{16}-C_{18} internal olefin] ÷ [4-day LC_{50} of drilling mud removed from drill cuttings at the solids control equipment] as determined by ASTM E 1367-92 method: "Standard Guide for Conducting 10-day Static Sediment Toxicity Tests with Marine and Estuarine Amphipods,"1992, after preparing the sediment according to the method specified in Appendix A of this permit.

[k] As determined before drilling fluids are shipped offshore by the GC/MS compliance assurance method (see part II.I.5 of this permit), and as determined prior to discharge by the Reverse Phase Extraction (RPE) method (see part II.H.6 of this permit) applied to drilling mud removed from drill cuttings. If the operator wishes to confirm the results of the RPE method, the operator may use the GC/MS compliance assurance method (part II.I.5 of this permit). Results from the GC/MS compliance assurance method shall supercede the results of the RPE method.

[l] This limitation is applicable only when the nonaqueous drilling fluids (NAF) base mud meets the stock limitations defined in this table.

[m] As determined by the American Petroleum Institute (API) retort method. See part II.I.7 of this permit.

[n] Monitoring shall be performed at least once per day when generating new cuttings, except when meeting the conditions of the Best Management Practices described in section II.B.3 below. Operators conducting fast drilling (i.e., greater than 500 linear feet advancement of the drill bit per day using nonaqueous muds) shall collect and analyze one set of drill cuttings samples per 500 linear feet drilled, with a maximum of three sets per day. Operators shall collect a single discrete drill cuttings sample for each point of discharge to the ocean. The weighted average of the results of all discharge points for each sampling interval would be used to determine compliance.

[o] Averaged over all well sections.

Table 2-6. Effluent Limitations and Monitoring Requirements for Deck Drainage and Storm Water Runoff

Effluent parameter	Units	Effluent limitations		Monitoring requirements	
		Average monthly limit	Maximum daily limit	Sample frequency	Sample type
Free oil	---	No discharge [a]		Daily [b]	Visual
Whole effluent toxicity [c]	TUc [e]	Report		Once during the first year the permittee is covered by the permit [d]	Part III.A
Flow	MGD	—		Monthly	Estimated

[a] If discharge occurs during broken or unstable ice conditions, or during stable ice conditions, the Static Sheen Test must be used (see Appendix 1 to 40 CFR Part 435, Subpart A).
[b] When discharging.
[c] Contaminated deck drainage must be processed through an oil-water separator prior to discharge, and samples for that portion of the deck drainage collected from the separator effluent must be sampled for whole-effluent toxicity (WET) testing.
[d] Sample must be collected during a significant rainfall or snowmelt. If discharge of deck drainage separate from produced water is initiated after the first year of the permit, sampling must occur during the year following the initiation of separate deck drainage discharge.
[e] With the final report for each test, the following must also be reported: date and time of sample, the type of sample (i.e., rainfall or snowmelt), estimate of daily flow and basis for the estimate (e.g., turbine meters, monthly precipitation, estimated washdown).

If deck drainage is commingled with produced water, this discharge must be considered produced water for monitoring purposes (see Section 2.2.5.6). However, samples collected for compliance with the produced water oil and grease limits must be taken prior to commingling the produced water stream with deck drainage or any other waste stream. The estimated deck drainage flow rate must be reported in the comment section of the discharge monitoring report (DMR).

2.3.3.3 Sanitary Wastewater

The monitoring requirements for the discharge of sanitary wastewater for the proposed general permit are shown in Table 2-7.

The term M10 refers to platforms continuously staffed by 10 or more persons. The term M9IM refers to platforms continuously staffed by nine or fewer persons or intermittently staffed by more persons. Intermittently staffed means staffed for fewer than 30 consecutive days.

For any facility using a marine sanitation device (MSD), the permittee must conduct annual testing of the MSD to ensure that the unit is operating properly. The permittee must note the results of the test on the December DMR.

In cases where the sanitary and domestic wastes are mixed prior to discharge and sampling of the sanitary waste component of the discharge is infeasible, the discharge may be sampled after mixing; however, the most stringent discharge limitations for both discharges apply to the mixed waste stream.

Table 2-7. Effluent Limitations and Monitoring Requirements for Sanitary Wastewater

Discharge	Effluent parameter	Effluent limitations		Monitoring requirements	
		Average monthly limit	Maximum daily limit	Sample frequency	Sample type
Sanitary Waste Water All Discharges [b]	Flow rate	Report		1/month	Estimate
	Fecal coliforms	Report		1/month [a]	Grab
	Floating solids	No discharge		1/day	Observation [a]
M10 MSD and MSD/Biological Treatment Units	BOD [c]	30 mg/L	60 mg/L	1/month	Grab
	TSS [c]	51 mg/L	67 mg/L	1/month	Grab
	Total residual chlorine	Between 1 mg/L and 2 mg/L		1/month	Grab
M9IM MSD and MSD/Biological Treatment Units	BOD [c]	30 mg/L	60 mg/L	1/month	Grab
	TSS [c]	51 mg/L	67 mg/L	1/month	Grab
M10 Biological Treatment Units	BOD [c]	30 mg/L	60 mg/L	1/month	Grab
	TSS [c, d]	30 mg/L	60 mg/L	1/month	Grab
	Total residual chlorine	Between 1 mg/L and 2 mg/L		1/month	Grab
M9IM Biological Treatment Units	BOD [c]	48 mg/L	90 mg/L	1/month	Grab
	TSS [c, d]	56 mg/L	108 mg/L	1/month	Grab

[a] The permittee must monitor by observing the surface of the receiving water in the vicinity of the outfall(s) during daylight at the time of maximum estimated discharge. For domestic waste, observations must follow either the morning or midday meal.

[b] In cases where sanitary and domestic wastes are mixed prior to discharge and sampling of the sanitary waste component stream is infeasible, the discharge may be sampled after mixing. In such cases, the discharge limitations for sanitary wastes must apply to the mixed waste stream.

[c] The numeric limits for BOD and TSS apply only to discharges to state waters.

[d] The TSS limitation for biological treatment units is a net value. The net TSS value is determined by subtracting the TSS value of the intake water from the TSS value of the effluent. Report the TSS value of the intake water on the comment section of the DMR. For those facilities that use filtered water in the biological treatment units, the TSS of the effluent may be reported as the net value. Samples collected to determine the TSS value of the intake water must be taken on the same day, during the same time period that the effluent sample is taken. Intake water samples must be taken at the point where the water enters the facility prior to mixing with other flows. Influent samples must be taken with the same frequency that effluent samples are taken.

2.3.3.4 Domestic Wastewater

The monitoring requirements for the discharge of domestic wastewater for the proposed general permit are shown in Table 2-8.

Table 2-8. Effluent Limitations and Monitoring Requirements for Domestic Wastewater

Discharge	Effluent parameter	Effluent limitations		Monitoring requirements	
		Average monthly limit	Maximum daily limit	Sample frequency	Sample type
Domestic Waste Water (004) note 2	Flow rate	Report		1/Month	Estimate
	Floating solids	No discharge		1/Day note1	Visual
	Foam	No discharge		1/Day	Visual

Footnotes:

1 The permittee must monitor by observing the surface of the receiving water in the vicinity of the outfall(s) during daylight at the time of maximum estimated discharge. For domestic waste, observations must follow either the morning or midday meal.

2 In cases where sanitary and domestic wastes are mixed prior to discharge, and sampling of the sanitary waste component stream is infeasible, the discharge may be sampled after mixing. In such cases, the discharge limitations for sanitary wastes must apply to the mixed waste stream.

In cases where the sanitary and domestic wastes are mixed prior to discharge, and sampling of the sanitary waste component of the discharge is infeasible, the discharge may be sampled after mixing, however, the most stringent discharge limitations for both discharges apply to the mixed waste stream.

2.3.3.5 Miscellaneous Discharges

The monitoring requirements associated with the discharge of miscellaneous categories (desalination unit wastes, blowout preventer mud, boiler blowdown, fire control system test water, non-contact cooling water, uncontaminated ballast water, bilge water, excess cement slurry, mud, cuttings, cement at the seafloor, and waterflooding must comply with the effluent limitations and monitoring requirements shown in Table 2-9.

Table 2-9. Effluent Limitations and Monitoring Requirements for Miscellaneous Discharges (Discharges 005–014)

Parameter	Effluent limitations		Monitoring requirements	
	Average monthly limit	Maximum daily limit	Sample frequency	Sample type
Flow	Report		Monthly	Estimate
Free oil	No discharge note 1	No discharge note 1	1/Week note 1	Visual
Chemical additives	See Section II.F.3 of draft permit		Monthly	Calculation
Whole-effluent Toxicity note 2	See Section II.F.4 of this permit	See Section II.F.4 of this permit	1/Quarter	Grab

Footnotes:

1 Discharge is limited to those times that a visible sheen observation is possible unless the operator uses the static sheen method. Monitoring shall be performed using the visual sheen method on the surface of the receiving water once per week during periods of slack tide when discharging, or by use of the static sheen method at the operator's option. The number of days a sheen is observed must be recorded. For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature that approximates surface water temperatures after breakup shall be used.

2 Applicable to discharges to which chemical additives have been added.

In addition to the monitoring requirements specified in Table 2-9, permittees must maintain an annual inventory of the quantities and rates of chemicals and biocides that are added to the desalination unit waste water. Each annual inventory must be assembled for the calendar year and submitted to EPA by March 1 of the following year.

2.3.3.6 Produced Water and Produced Sand

The monitoring requirements for produced water discharged from existing facilities are shown in Table 2-10. There are no monitoring requirements for produced sand because no discharges are allowed.

Table 2-10. Effluent Limitations and Monitoring Requirements for Produced Water and Produced Sand

Parameter	Effluent Limitations		Monitoring Requirements	
	Monthly average	Daily maximum	Sample frequency	Sample type
Flow Rate	Report	Report	1/Week	Estimate
Produced Sand	No Discharge	No Discharge		
Oil and Grease	29 mg/L	42 mg/L	1/Week	Grab note 1
pH < 1 MGD	6.0 to 9.0 S.U.		1/Month	Grab
pH > 1 MGD	6.0 to 9.0 S.U.		1/Week	Grab
Free Oil	Report		1/Day note 2	Visual sheen

Footnotes

1 The sample type shall be either grab, or a 24-hour composite, which consists of the arithmetic average of the results of four grab samples taken over a 24-hour period. If only one sample is taken for any one month, it must meet both the daily and monthly limits. Samples shall be collected prior to the addition of any seawater to the produced water waste stream.

2 See Section II.G.6.b of the draft permit.

In addition to the monitoring requirements shown in Table 2-10, produced waters must be analyzed once a month for total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH) in accordance with the analytical requirements cited in Alaska Water Quality Standards (18 AAC 70.020(b)); once a month for ammonia, total copper, total mercury, total nickel, and total zinc; and once a quarter for whole-effluent toxicity.

The proposed general permit would reduce the monitoring frequency for produced water if the permittee has complied with the water quality-based effluent limits (WQBELs) for 12 consecutive months. Compliance with water quality limits would be determined on the basis of measured sample results and the application of the dilution factors shown in Tables 2-3 and 2-4 for the mixing zones proposed in Table 2-2. If compliance has been achieved for 12 consecutive months, the monitoring frequency for TAH, TAqH, ammonia, total copper, total, mercury, total nickel, and total zinc would be reduced to once per quarter; the monitoring frequency for whole effluent toxicity would be reduced to once every 6 weeks.

If the permittee has not complied with the WQBELs, the proposed general permit would increase the monitoring frequency for produced water until compliance has been demonstrated for 3 consecutive months. After compliance has been established for 3 months, the required frequency would return to the default frequency of one sample per month (TAH, TAqH, ammonia, total copper, total, mercury, total nickel, and total zinc) or one sample per quarter whole-effluent toxicity). The increased monitoring frequency would be once per week for TAH, TAqH, ammonia, total copper, total, mercury, total nickel, and total zinc and once per month for whole-effluent toxicity.

2.3.3.7 Fate and Effects Monitoring for Large-Volume Produced Water Discharges

The expired general permit required operators of new facilities located within 4,000 meters of coastal marshes to conduct baseline monitoring. However, no new facilities were located within 4,000 meters of coastal marshes, so no baseline monitoring was conducted under the expired permit. To fulfill EPA's requirements under Clean Water Act (CWA) section 403(c), which requires that the potential impacts of permitted discharges be fully understood, the monitoring requirement from the expired general permit is proposed to be extended to cover all new facilities installed after the effective date of the new permit.

2.3.3.8 New Study Requirements

Few ambient data associated with oil and gas discharges in Cook Inlet currently exist. The only available sediment data were collected in the far southern portions of Cook Inlet, well over 100 miles from the existing large-volume produced water discharges. Although those data could indicate whether general contamination exists, because of the collection location, there is no way to draw a connection to the existing produced water discharges. Available ambient water column data relevant to the existing discharges are also extremely limited. Because of the data limitations, EPA has historically relied on tools like dispersion modeling to analyze the potential effects of discharges for permitting decisionmaking.

As a means to increase available ambient data and ensure that future permit decisions are based on a better body of information, the proposed general permit would require new fate and effects monitoring for large-volume produced water discharges. Under this new requirement, an operator with a produced water discharge greater than 100,000 gallons per day would be required to conduct a sediment and water column sampling study. The goal of the study is to determine if there is a reasonable potential for large-volume produced water discharges to adversely affect sensitive areas of Cook Inlet. To achieve that goal, the proposed permit would require that operators plan and conduct studies that at a minimum would include the collection of both sediment and water column samples at 50-meter intervals over a distance of 2,000 meters between the discharge point and the closest sensitive habitat. Sediment would be sampled by a minimum of one box core or similar sample collected at each station. At a minimum, water column monitoring would include collection of a sample from both the mid and lower water column at each station. All samples would be analyzed for the metals and hydrocarbons that are limited in produced water discharges. An operator with large-volume produced water discharges would be required to submit a study plan to EPA for approval before starting to monitor. Because the studies would be in areas within Alaska state waters, EPA plans to coordinate review of the study plans with ADEC and obtain input as a part of the approval process. Therefore, operators would be required to submit their plans to ADEC as well as to EPA.

Pursuant to the Ocean Discharge Criteria, EPA is required to fully understand the potential impacts on the marine environment of future large-volume discharges that might be placed in Cook Inlet. The information obtained from these studies would help EPA comply with the requirements of Ocean Discharge Criteria Evaluations in future permitting actions. In addition, EPA and ADEC would use the information to determine whether any future changes to the permit conditions are needed to meet the requirements of Alaska's Water Quality Standards.

3.0 ESSENTIAL FISH HABITAT WITHIN PROJECT AREA

An EFH assessment is applied to the defined EFH for all species managed under a federal Fisheries Management Plan (FMP). Currently three FMPs have fisheries resources that might be affected by the proposed action:

- The Fisheries Management Plan for Groundfish of the Gulf of Alaska
- The Fisheries Management Plan for Scallop Fishery off Alaska
- The Fisheries Management Plan for the Salmon Fisheries in the exclusive economic zone (EEZ) off the Coast of Alaska

NOAA Fisheries has recently completed an environmental impact statement (EIS) defining EFH for the Alaskan region affected by these and other FMPs (NMFS 2005). The definition NOAA Fisheries uses for a species' EFH is based on the subset of the species' population and is 95 percent of the population for a particular life stage, if life history data are available for the species. Where information is insufficient and a suitable proxy cannot be inferred, EFH is not described for that species life stage.

The EFH species and life stages present in the Gulf of Alaska are shown for groundfish, weathervane scallops, and salmon in Tables 3-1, 3-2, and 3-3, respectively. EFH species and life stages present in the project area (Figure 1-2) are indicated in these tables. Species that have at least one life stage defined as having EFH in the project area are discussed in Section 3.1. Detailed maps of defined EFH species' life stage distribution for the Gulf of Alaska, including the project area, are presented in the EIS (NMFS 2005), Appendix D, and are not included here.

Table 3-1. Gulf of Alaska Groundfish EFH Species Life Stages Present in the Project Area

Gulf of Alaska species	Eggs	Larvae	Early juvenile	Late juvenile	Adult
Walleye pollock	1	1	-	1	1
Pacific cod	2	1	-	1	1
Yellowfin sole	2	2	-	2	2
Arrowtooth flounder	-	1	-	1	1
Rock sole	-	1	-	1	1
Alaska plaice	1	2	-	1	1
Rex sole	1	1	-	1	1
Dover sole	1	1	-	1	1
Flathead sole	1	1	-	1	1
Sablefish	2	1	-	1	1
Shortraker/rougheye rockfish	-	1	-	2	2
Northern rockfish	-	1	-	-	2
Thornyhead rockfish	-	1	-	2	2
Yelloweye rockfish	-	1	-	2	2
Dusky rockfish	-	1	-	-	2
Atka mackerel	-	2	-	-	2
Sculpins	-	-	-	1	1
Skates	-	-	-	-	1
Sharks	-	-	-	-	-
Forage fish complex	-	-	-	-	-
Squid	-	-	-	1	1
Octopus	-	-	-	-	-

- = no information is available to define EFH in the Gulf of Alaska.
1 = life stage with defined EFH in the project area.
2 = life stage with defined EFH, but none in the project area.
Source: NMFS 2005.

Table 3-2. Alaska Scallops' EFH Life Stages Present in the Project Area

Scallop species	Egg	Larvae	Early juvenile	Late juvenile	Adult
Weathervane	-	-	-	1	1

- = no information is available to define EFH in the Gulf of Alaska.
1 = life stage with defined EFH in the project area.
2 = life stage with defined EFH, but none in the project area.
Source: NMFS 2005.

Table 3-3. Salmon Species' EFH Life Stages Present in the Project Area

Salmon species	Freshwater eggs	Freshwater larvae and juveniles	Estuarine juveniles	Marine juveniles	Marine immature and maturing adults	Freshwater adults
Pink	2	2	1	1	1	2
Chum	2	2	1	1	1	2
Sockeye	2	2	1	1	1	2
Chinook	2	2	1	1	1	2
Coho	2	2	1	1	1	2

- = no information is available to define EFH in the Gulf of Alaska.
1 = life stage with defined EFH in the project area.
2 = life stage with defined EFH, but none in the project area.
Source: NMFS 2005.

3.1 Species Essential Fish Habitat Descriptions

This section presents information on EFH characteristics and general life history for only species with defined EFH in the project area. Species without defined EFH in the project area are not discussed. With the exception of EFH for salmon species, all other defined EFH in the project area (Figure 1-2) is limited to the outer third of Cook Inlet, with most near or just outside the Cook Inlet entrance. (See Appendix D of NMFS 2005.)

3.1.1 Walleye Pollock

The egg, larval, late juvenile and adult life stages of walleye pollock have essential fish habitat in the project area. With the exception of the adult life stage, which extends into Kachemak Bay, all others are restricted to extending slightly inside the Cook Inlet entrance. Eggs, which are pelagic, are found at depths from 0 to 1000 m. The epipelagic larvae have a similar distribution. Juveniles and adults are most often in the lower and middle portions of the water column, at depths less than 200 m for juveniles and less than 1000 m for adults. These life stages have no substrate preference. Seasonal migrations occur from the outer continental shelf to shallow waters (90 to 140 m, or 295 to 459 ft) for spawning. Spawning takes place in early spring; the eggs hatch in about 10 to 20 days, depending on water temperature, and larvae spend 20 to 30 days in the surface waters.

3.1.2 Pacific Cod

EFH for larvae, late juveniles, and adults is present in the NPDES permit area, however only the adult stage EFH extend well into Cook inlet, while others are restricted to near the entrance. Pacific cod is a demersal species that occurs on the continental shelf and upper continental slope. Spawning habitat occurs along the continental shelf and slope from about 40 to 290 m (131 to 951 ft); spawning typically occurs from January to April. The optimal conditions for embryo development are water temperatures between 3 and 6 ˚C and dissolved oxygen concentrations from 2 to 3 ppm saturation. The larvae are epipelagic, occurring primarily in the upper 45 m (148 ft) of the water column shortly after hatching, and they move downward in the water column as they grow. The larvae occur primarily in waters less than 100 m deep over soft substrate. Juvenile and adult EFH occurs in the lower portion of the water column in the inner, middle, and outer continental shelf from 0 to 200 m, where their preferred substrate is soft sediment primarily from mud to gravel (NMFS 2005).

3.1.3 Arrowtooth Flounder

EFH in the project area includes larvae, near the Cook Inlet entrance, and juveniles and adults, extending into Cook Inlet as far as Kachemak Bay. All life stages of Arrowtooth flounder occur in the inner continental shelf regions with water depths ranging from 1 to 50 m (3 to 164 ft). Spawning is thought to occur from September through March. Larvae are planktonic for at least 2 to 3 months until metamorphosis occurs; juveniles usually inhabit shallow areas. Adults are found in continental shelf waters until age 4, and they occupy both shelf and deeper slope waters at older ages with highest concentrations at 100 to 200 m (NMFS 2005). Both adults and juveniles are often found over soft substrate, typically mud and sand, in the lower portion of the water column.

3.1.4 Rock Sole

Project area EFH for larvae occurs near the Cook Inlet entrance, while juvenile and adult EFH extends beyond the Kachemak Bay entrance. All life stages of rock sole except the egg stage occur in the inner continental shelf regions. Spawning takes place during late winter/early spring near the edge of the continental shelf at depths from 125 to 250 m (410 to 820 ft). The eggs are demersal and adhesive. The larvae are planktonic for at least 2 to 3 months until metamorphosis occurs. The juveniles inhabit shallow waters until at least age 1 (NMFS 2005). Juveniles and adults occur over moderate to softer substrates of sand, gravel, and cobble, mostly at depths from 0 to 200 m.

3.1.5 Alaska Plaice

EFH for Alaska plaice in the project area includes eggs, late juveniles, and adults. The EFH for all three life stages is at the outer edge of the project area, outside Cook Inlet. Alaska plaice is considered a “deep water” species in the Gulf of Alaska groundfish management area. Eggs are present over a range of depths (0 to 500 m) in the spring. Juvenile and adult EFH is in the lower portion of the water column at depths of 0 to 200 m, over sand and mud substrate (NMFS 2005).

3.1.6 Rex Sole

Egg, larval, late juvenile, and adult EFH is present in the project area. All EFH is present only in the NPDES area at the entrance of Cook Inlet. Eggs and larvae are present over a range of depths (0 to 500 m) in the spring. EFH of juveniles and adults is in the lower portion of the water column at depths of 0 to 200 m, over gravel, sand, and mud substrate (NMFS 2005).

3.1.7 Dover Sole

The project area EFH for Dover sole egg, larval, late juvenile, and adult life stages is present only near the Cook Inlet entrance. This fish is considered a “deep water flatfish” in the Gulf of Alaska management area. The EFH ranges to great depths (0 to 3,000 m) for larvae and eggs, although adult and juvenile EFH is less deep (0 to 500 m) in the middle and outer shelf and upper slope areas, occurring in the lower portion of the water column over soft substrate of sand and mud (NMFS 2005).

3.1.8 Flathead Sole

The flathead sole EFH for eggs and larvae extends inside the Cook Inlet entrance, while late juvenile and adult habitat extends into Kachemak Bay in the project area. The adults are benthic and have separate winter spawning and summer feeding distributions. The fish over-winter near the continental shelf margin and then migrate onto the mid and outer continental shelf areas in the spring to spawn in deepwater areas near the margin of the continental shelf. The eggs are pelagic, and the larvae are planktonic, and usually inhabit shallow areas. Egg and larval EFH ranges from 0 to 3000 m, while juveniles' and adults' EFH is shallower (0 to 200 m) and occurs over sand and mud substrate. Like all flatfish, flathead sole occur in the lower portion of the water column.

3.1.9 Sablefish

The EFH for larval, juvenile, and adult sablefish is present only at the entrance of the Cook Inlet in the project area. Spawning is pelagic at depths of 300 to 500 m (984 to 1,640 ft) near the edges of the continental slope. Larvae are oceanic through the spring; by late summer, small juveniles (10 to 15 cm [4 to 6 in]) occur along the outer coasts of southeast Alaska, where they predominantly spend their first winter. First- to second-year juveniles are found primarily in nearshore bays; they move to deeper offshore waters as they age, with EFH habitat at depths of 200 to 1,000 m. Adults are found on the outer continental shelf mainly on the slope and in deep gullies at typical depths of 200 to 1000 m, over varied habitat, usually in soft substrate (NMFS 2005).

3.1.10 Rockfish

Some 32 rockfish species are present in Alaskan waters, but only 7 rockfish species (Table 3-1) have designated EFH in the Gulf of Alaska (NMFS 2005). The EFH of larvae for all rockfish species is grouped, not separated by species. Within the project area rockfish larvae are present only near the Cook Inlet entrance. No juvenile or adult EFH for any of the seven rockfish species is present in the project area because all habitat for these life stages is present in deeper water, often near the continental shelf, or in other nearshore areas of the Gulf of Alaska. The EFH for rockfish larvae is characterized as being in the entire shelf (0 to 200 m) and slope areas (200 to 3000 m), except the EFH for Pacific Ocean perch, which extends only to a 500 m depth in the upper slope area. In general, rockfish tend to be demersal as late juveniles and adults, although some species are pelagic occupying midwater areas. Many species are associated with rocky substrates. Rockfish have internal fertilization and release live young in the spring (NMFS 2005).

3.1.11 Sculpins

The EFH for juvenile and adult sculpins in the project area is present only in a narrow band extending from Kachemak Bay in the east to Kamishak Bay, north of Augustine Island, to the west (NMFS 2005). Both juveniles and adults are present in the lower portion of the water column in the inner, middle, and outer shelf (0 to 200 m) and also in the upper slope (200 to 500 m) in the Gulf of Alaska, over varied substrate (mud to rock). Most spawning occurs in the winter, and some species have internal fertilization. Typically eggs are laid in rocks, where males guard them. Larvae often have diel migration (near the surface at night) and might be present year-round.

3.1.12 Skates

The EFH for adult skates extends well into the Cook Inlet project area, beyond Kachemak Bay, and covers most of outer third of the Inlet (NMFS 2005). Adult EFH is found in waters of 0 to 500 m on shelf and upper slope areas. Adult skates are present in the lower portion of the water column over varied substrate from mud to rock. Skates are oviparous, fertilization is internal, and eggs are deposited in a horny case for incubation. After hatching, the juveniles likely remain in shelf and slope waters, but their distribution is unknown. No data on habitat requirements or movement are available (NMFS 2005).

3.1.13 Squid

The EFH for juvenile and adult squid is present only in the outer portion of the project area, between Cape Douglas and the Barren Islands, outside Cook Inlet. Juveniles and adults use the entire water column over the shelf (0 to 500 m) and all the slope (500 to 1,000 m) regions (NMFS 2005). Reproduction is poorly known, but fertilization is internal, and squid lay eggs in gelatinous masses in water 200 to 800 m deep. Young juveniles are often in water less than 100 m deep, while older juveniles and adults are more often in waters 150 to 500 m deep. Spawning occurs in the spring (NMFS 2005).

3.1.14 Weathervane Scallop

The designated EFH for late juvenile and adult weathervane scallops extends well into the outer half of Cook Inlet to beyond the entrance to Kachemak Bay. The EFH habitat of late juveniles and adults is along the seafloor in the middle (50 to 100 m) to outer (100 to 200 m) shelf areas. It is generally elongated along the current lines, as is apparent in the EFH in Cook Inlet, which tends to be in an elongated distribution toward the middle of the inlet (NMFS 2005). The scallops are generally over clay to gravel substrates. Although they are capable of swimming, they usually remain along seafloor depressions. Fertilization is external, and pelagic larvae drift for a month before they settle to the seafloor (NMFS 2005).

3.1.15 Pink Salmon

The essential fish habitat for pink salmon within the project area includes estuarine juvenile, marine juvenile, and marine immature and maturing adults (NMFS 2005). The estuarine EFH is the mouth areas of streams from the mean high tide line to the salinity transition zone. All other marine life stage EFH includes the entire project area because EFH for this species extends from the mean higher tide line to the 200 nautical mile limit of the U.S. EEZ. This species is pelagic to a depth of about 200 m. Pink salmon spawn in small streams within a few miles of the shore, within the intertidal zone, or at the mouths of streams. Eggs are laid in stream gravels. After hatching, salmon fry move downstream to the open ocean. Pink salmon stay close to the shore, moving along beaches during their first summer feeding on plankton, insects, and small fish. At about 1 year of age, pink salmon move offshore to ocean feeding areas.

3.1.16 Chum Salmon

The EFH for chum salmon within the project area includes estuarine juveniles, marine juveniles, and marine immature and maturing adults (NMFS 2005). The estuarine EFH is the mouth areas of streams from the mean high tide line to the salinity transition zone. All other marine life stage EFH includes the entire project area because EFH for this species extends from the mean higher tide line to the 200-nautical-mile limit of the U.S. EEZ. This species is pelagic to a depth of about 200 m. Most chum salmon spawn in small streams within a few miles of the shore, or within the intertidal zone, but some travel great distances up large rivers. Eggs are laid in stream gravels. After hatching, salmon fry move downstream to the open ocean.

3.1.17 Sockeye Salmon

The EFH for sockeye salmon within the project area includes estuarine juveniles, marine juveniles, and marine immature and maturing adults (NMFS 2005). The estuarine EFH is the mouth areas of streams from the mean high tide line to the salinity transition zone. All other marine life stage EFH includes the entire project area because EFH for this species extends from the mean higher tide line to the 200-nautical-mile limit of the U.S. EEZ. This species is pelagic to a depth of about 200 m. Sockeye spawn in stream systems with lakes. After 1 to 3 years in fresh water lakes, the fry move downstream to the open ocean.

3.1.18 Chinook Salmon

The EFH for Chinook salmon within the project area includes estuarine juveniles, marine juveniles, and marine immature and maturing adults (NMFS 2005). The estuarine EFH is the mouth areas of streams from the mean high tide line to the salinity transition zone. All other marine life stage EFH includes the entire project area because EFH for this species extends from the mean higher tide line to the 200-nautical-mile limit of the U.S. EEZ. This species is pelagic to a depth of about 200 m. Chinook spawn in small and large streams, and the eggs are laid in stream gravels. After hatching, salmon fry move downstream to the open ocean.

3.1.19 Coho Salmon

The EFH for coho salmon within the project area includes estuarine juveniles, marine juveniles, and marine immature and maturing adults (NMFS 2005). The estuarine EFH is the mouth areas of streams from the mean high tide line to the salinity transition zone. All other marine life stage EFH includes the entire project area because EFH for this species extends from the mean higher tide line to the 200-nautical-mile limit of the U.S. EEZ. This species is pelagic to a depth of about 200 m. Coho salmon spawn in small streams and the eggs are laid in stream gravels. After 1 to 3 years in fresh water ponds, lakes, and stream pools, the salmon fry move downstream to the open ocean.

4.0 EFFECTS OF THE PROPOSED ACTION ON EFH

The direct and indirect effects of activities associated with the NPDES permit for the Cook Inlet project area have been assessed in documents related to this EFH. The Biological Evaluation for listed species in the project area for issuance of this NPDES permit addresses the effects of various chemical discharges on marine organisms, and major portions of that study are incorporated within this EFH. Another document, the *Final Environmental Impact Statement for the Cook Inlet Planning Area Oil and Gas Lease Sales 191 and 199* (MMS 2003), includes an

EFH that addresses the effects of permitted actions in the project area, including chemical discharges in Cook Inlet as well as related activities such as seismic testing, associated boat traffic, and potential oil spills. That document and the Fact Sheet for the reissuance of the general permit for oil and gas exploration, development and production facilities in Cook Inlet were used extensively in assessing potential effects on EFH in the project area.

The following sections address the effects on EFH in the project area under types of effects or actions. Each section includes a description of the parameter, followed by an assessment of the effect of that parameter on EFH.

4.1 Drilling Fluids and Cuttings

Drilling fluids are complex mixtures of clays and chemicals, and their potential impact on marine organisms has been examined in several studies. Recent reviews of studies conducted in federal Outer Continental Shelf (OCS) areas include Neff (1982), National Research Council (1983), Petrazzuolo et al. (1985), and Parrish and Duke (1990). Drill cuttings are the waste rock particles brought up from the well hole during exploratory drilling operations.

The permit restrictions for drilling fluids and cuttings are provided in Sections 2.3.1.1 and 2.3.1.2, respectively. No discharge of drilling fluids or cuttings would be allowed for new development and production facilities. Existing facilities would be allowed to discharge drilling fluids and cuttings subject to technology-based restrictions that (1) prohibit the discharge of free oil; (2) prohibit the discharge of diesel oil and set a minimum toxicity limit of 3 percent by volume; (3) allow maximum concentrations of 3 mg/kg cadmium and 1 mg/kg mercury in stock barite; (4) prohibit the discharge of nonaqueous-based drilling fluids, except those which adhere to drill cuttings; and (5) prohibit the discharge of oil-based drilling fluids, inverse emulsion drilling fluids, oil-contaminated drilling fluids, and drilling fluids to which mineral oil has been added.

MMS (2003) estimated that the completion of each exploration or delineation well would result in the discharge of an estimated 140 tonnes (metric dry weight) of drilling fluids and 400 tonnes of cuttings. The drilling of production and service wells from an existing platform is estimated to require disposal of 70 tonnes of drilling mud and 500 tonnes of cuttings per well.

The Offshore Operators Committee (OOC) and Exxon Production Research Company have developed a model (the OOC model) that has been used extensively in Alaskan waters to predict the transport and deposition of drilling fluids. Comparison of model results with field observations has shown that the model is capable of predicting many important aspects of drilling mud discharge plume behavior. When released into the water column, the drilling mud separates into an upper plume, which contains fine-grained solids, and a lower plume, which contains the majority of solids. The OOC model does not predict the fate and transport of cuttings. These materials are expected to be of coarser grain size than drilling fluids and would therefore settle more rapidly to the seafloor. Model simulations of drilling mud discharges in Cook Inlet show that both solids and dissolved components are diluted rapidly with distance from the point of discharge. At 100 m (328 ft) from the point of discharge, the dilution factors ranged from 905 to 5,793 for discharges in water depths ranging from 40 m (131 ft) to 120 m (394 ft) (Tetra Tech 1993). Dilution factors for dissolved components ranged from 1,285 to 9,127 for discharges to the same range of water depths (Tetra Tech 1993).

4.1.1 Turbidity

Drilling fluids and cuttings discharged into Cook Inlet would increase the turbidity of the water column and the rate of accumulation of particulate matter on the seafloor in the vicinity of the exploratory drilling unit or existing platform. Most of the solids in the discharge (more than 90 percent) are predicted to descend rapidly (within 1 hour) to the seafloor as part of the lower mud plume (MMS 2003). Dye studies and modeling of the discharge plume associated with the drilling of a well in lower Cook Inlet during 1977, at a site between Kachemak and Kamishak bays, indicated rapid dilution to a minimum value of 10,000:1 within 100 m of the drilling vessel (MMS 2003). Following dilution, the increase in turbidity was estimated to be about 8 ppm; background turbidity in the area ranged from 2 to 20 ppm.

The finer-grained material that does not rapidly settle might be kept in suspension by turbulence or settle to the seafloor farther away from the point of discharge. These particulates can cause an increase in turbidity. In general, however, the concentration of suspended particulate matter in the water column is expected to be reduced to levels comparable to naturally occurring suspended particulate matter (1 to 50 ppm) within about 100 to 200 meters of the discharge site (MMS 2003).

Only part of the solids in the drilling fluids and cuttings discharged into Cook Inlet might accumulate near the discharge. The bottom currents in lower Cook Inlet are strong enough to prevent the deposition of sand-size and smaller particles. The general southwest flow of Cook Inlet currents indicates that discharged substances that are dissolved or remain in suspension generally would be transported out of Cook Inlet and into the Gulf of Alaska within about 10 months (MMS 2003).

4.1.2 Chemical Toxicity

A variety of Alaskan marine organisms have been exposed to drilling mud in laboratory or field experiments. Most of these studies have addressed short-term acute[1] effects in a relative or "screening" sense, with little effort directed at separating chemical from physical causes. A few studies have looked at chronic sublethal effects and bioaccumulation of heavy metals from drilling mud. *Chronic* is used to refer to a stimulus that lingers or continues for a relatively long period, often 1/10 of the life span of an organism or more (USEPA 1990). Results are typically reported as LC_{50}s (concentrations lethal to 50 percent of the test organisms) or EC50s (median effective concentrations, or the concentrations at which a designated effect is displayed by 50 percent of the test organisms). Because drilling mud discharges are episodic and typically only a few hours in duration (Jones and Stokes 1990), organisms that live in the water column are not likely to have long-term exposures to drilling fluids and risks to these organisms are best assessed using acute toxicity data. Benthic organisms, particularly sessile species, are likely to be exposed for longer periods; risks to these organisms are best assessed with chronic toxicity data.

As noted above, the effects of drilling fluids on biological organisms are most commonly assessed by conducting acute laboratory toxicity tests. Results obtained in most studies to date have not shown drilling mud to have a high degree of acute toxicity (USEPA 1988a; 1988b). For example, Parrish and Duke (1990) reviewed research findings on the toxicity of drilling fluids used in the Gulf of Mexico and concluded that available models suggest that discharges made

[1] In aquatic toxicity tests, a response measuring lethality observed in 96 hours or less is typically considered acute (USEPA 1990).

from oil platforms in open, well-mixed waters deeper than about 20 m (66 ft) would result in no detectable acute effects, except within a few hundred meters of the point of discharge.

The general NPDES permit has incorporated a standard acute toxicity test using the amphipod *Leptocheirus plumulosus.* Under the permit, discharge of drilling fluids with an LC_{50} of less than 30,000 ppm SPP (suspended particulate phase) is prohibited. The classification of relative toxicity of chemicals to marine organisms proposed by the IMCO/FAO/UNESCO/WHO, reported by Neff (1991), provides a means of qualitatively assessing relative toxicities (MMS 2003). Concentrations less than 1 ppm are classified as very toxic; 1 to 100 ppm, toxic; 100 to 1,000 ppm, moderately toxic; 1,000 to 10,000 ppm, slightly toxic; and greater than 10,000 ppm, practically nontoxic. The NPDES permit would allow discharge of drilling fluids only from exploratory wells and existing platform facilities, and the muds discharged from such facilities would be considered "practically nontoxic." Drilling fluid toxicity data compiled by USEPA (1993) from Alaskan exploratory and production wells indicate that the muds used in all current and recent operations are acutely toxic to only a slight degree to *Mysidopsis bahia.* LC_{50}s for the 91 valid toxicity test data points ranged from 2,704 to 1,000,000 ppm SPP with a mean of 540,800 ppm. Only 7 of the 91 tests had LC_{50}s less than the 30,000-ppm limit.

Although the discharge of nonaqueous-based drilling fluids would be prohibited under the proposed permit (see Section 2.3.1.1), it is proposed that the discharge of drill cuttings that are generated using nonaqueous-based drilling fluids be authorized by the reissued permit. These new discharges are proposed to be authorized only in the territorial seas and federal waters in Cook Inlet. Nonaqueous-based drilling fluids, also known as synthetic-based muds (SBM), are a pollution prevention technology because the drilling fluids are not disposed of through bulk discharge at the end of drilling. Instead, they are brought back to shore and refurbished so that they can be reused. Drilling with SBMs allows operators to drill a slimmer well and causes less erosion of the well during drilling than drilling using water-based drilling fluids. Therefore, relative to drilling with water-based drilling fluids, the volume of drill cuttings discharged is reduced.

Unlike the water-based drilling fluids, the SBMs are not water-soluble and do not disperse in the water column, as do water-based drilling fluids, but rather sink to the bottom with little dispersion (USEPA 2000). Since 1984 EPA has used the suspended particulate phase toxicity test, an aqueous-phase toxicity test, to evaluate the toxicity of drilling fluids, including SBMs. By using the SPP toxicity test, SBMs have routinely been found to have low toxicity; however, an inter-laboratory variability study indicated that SPP toxicity results are highly variable when applied to SBMs (USEPA 2000). In general, benthic test organisms appear to be more sensitive to the SBMs than are water-column organisms. The ranking for SBM toxicity from least toxic to most toxic is esters<internal olefins<linear alpha olefins<polyalphaolefins<paraffins (USEPA 2000).

Few studies have evaluated impacts on Alaskan species following chronic exposure to drilling fluids. The species that have been tested are all invertebrates. The test results are summarized in Appendix Table F-2 of OCS Lease Sale 87 and State Lease Sales 39, 43, and 43a ODCE (USEPA 1984). The lowest reported concentration of drilling mud that produced a significant sublethal chronic effect was 50 mg/L for 30 days of continuous exposure with bay mussels, and there was no attempt to separate chemical effects from physical effects (USEPA 1988a).

A laboratory study examined the chronic toxicity of cuttings from Beaufort Sea wells on the sand dollar (*Echinarachnius parma*) (Osborne and Leeder 1989). Exposure to mixtures as low as 10 percent cuttings/90 percent sand were found to affect the survival of the benthic organisms; 100 percent mortality occurred within 23 days in some test cases.

4.1.3 Effects on EFH

The discharge of drilling fluids and cuttings is not likely to cause acute effects on EFH habitat organisms, including prey resources such as those living in or on the substrate (MMS 2003). Minimal effects would result because the discharge would meet water quality standards outside the mixing zone, rapid dilution would occur in the mixing zones (see section on mixing zones), and drilling would be timed relative to important life stages of fish and fish prey. Within the mixing zones some sublethal effects, and possibly lethal effects at the discharge point (within 1 to 2 meters), might occur. Adverse effects within the mixing zone would be primarily from physical factors such as burial (MMS 2003). Some temporary displacement of organisms (e.g., fish, shellfish) might occur within the mixing zones, which could be reoccupied following cessation of discharge. Overall adverse effects on EFH from the discharge of drilling fluids and cuttings, relative to total EFH in the project area and the few areas with discharge (six sites, Table 2-2), would be negligible.

4.2 Produced Water

The term *produced water* refers to the water brought up from the oil-bearing, subsurface geologic formations during the extraction of oil and gas. It can include formation water, injection water, and any chemicals added to the well hole or added during the oil/water separation process (USEPA 1996).

All the existing development and production facilities in Cook Inlet are in coastal waters in the area north of a line extending across Cook Inlet at the southern edge of Kalgin Island (Figure 1-1). Federal guidelines for the coastal subcategory of the oil and gas extraction point source category allow the discharge of produced waters to Cook Inlet coastal waters provided these discharges meet a monthly average oil and grease limit of 29 mg/L and a daily maximum oil and grease limit of 42 mg/L. These limits are contained in the expired general permit for produced water and would be included without modification, for existing facilities only, in the reissued general permit. Produced water would not be authorized for discharge in either coastal or offshore waters for new sources.

Table 4-1 shows data compiled by EPA (USEPA 1996) from several sampling programs to characterize the composition of produced water in Cook Inlet.

Table 4-1. Chemical Analyses of Produced Water Samples: Source Samples from Shelikof Strait Sediment Quality Study and Produced Water Samples from the Trading Bay Production Facility Outfall

Parameters	Net weight (parts per million wet weight)
Total PAHs	0.380
Total PHCs	6.20
Silver	<0.0001
Arsenic	0.0024
Barium	20.7
Beryllium	<0.0001
Cadmium	0.000
Chromium	0.0032
Copper	0.0060
Iron	0.76
Mercury	<0.0005

Manganese	1.71
Nickel	0.0075
Lead	0.0001
Antimony	0.0001
Selenium	<0.0002
Tin	0.008
Thallium	0.00025
Vanadium	0.067
Zinc	0.0030

Notes:
< = less than
PAHs = polycyclic aromatic hydrocarbons
PHCs = petroleum hydrocarbons

4.2.1 Effects on EFH

The discharge of processed water might have slight adverse effects on EFH in very limited regions of the project area. Although some processed water might have toxic characteristics to marine biota, several factors would greatly limit its effects on EFH. First, new development in the region of outer Cook Inlet, where the greatest number of EFH individual species habitats occurs in the project area, would have processed water injected back to the underlying rock or taken to shore for treatment. In addition, discharged processed water has very low toxicity to marine organisms. Overall bioassay studies of the processed water have rated it "slightly toxic" to "practically nontoxic" (MMS 2003). Therefore, much of the water would have minimal direct toxic affects on EFH species or their habitat. Although a variety of components in the discharge water could affect toxicity, most currently meet state water quality standards (Department of Environmental Conservation 2003a, 2003b) (Table 4-1). The primary exception to meeting state water quality standards (Department of Environmental Conservation 2003a, 2003b) in the discharge water would be total hydrocarbons in the water column (15 parts per billion) and total aromatic hydrocarbons in the water column (10 parts per billion), which would likely be exceeded at the point of discharge (MMS 2003)(Table 4-1). EPA does not include criteria for these compounds directly; however, EPA's draft general permit does include criteria for total oil and grease and individual hydrocarbons. Dilution (well over 1,000:1 at most sites, Table 2-3) in the allowed mixing zone for existing facilities would result in the state standard's being met for the hydrocarbon parameters beyond the mixing zone. However, within the mixing zones established in the reissued general permit and ADEC's 401 certification, acute and chronic criteria would be exceeded. This would result in very slight adverse effects on EFH in the inner portion of Cook Inlet where processed water discharge would be allowed.

4.3 Mixing Zones and Water Quality Standards

The general NPDES permit would authorize mixing zones as described in Section 2.3.2.1 and would require that numeric criteria for chronic aquatic life be met at the boundary of the mixing zone. To evaluate potential affects on EFH species, two issues need to be addressed: (1) whether adverse effects would occur as a result of exposure to contaminant concentrations above water quality standards within the mixing zone boundaries and (2) whether the water quality standards are protective of EFH species.

4.3.1 Mixing Zones

States and EPA establish mixing zones to minimize the portion of a waterbody in which water quality criteria are exceeded. Alaska's Water Quality Standards require that when mixing zones are authorized, they be as small as practicable. Numeric criteria for chronic aquatic life and human health protection may be exceeded within the mixing zone, but they must be met at its boundary. The standards (18 AAC 70.255) also require that there be no lethality to organisms passing through mixing zones and that acute aquatic life criteria be met at the boundary of a smaller zone of initial dilution established within the mixing zone.

Alaska's Water Quality Standards do not allow ADEC to authorize mixing zones if the pollutants could bioaccumulate or persist in concentrations above natural levels in the environment, or if they can be expected to cause a carcinogenic or other human health risk. ADEC is required to take into account the potential exposure pathways in determining whether to authorize mixing zones. ADEC has determined that the discharges authorized by the previous permit are not likely to persist in the environment and therefore has authorized mixing zones. The state has previously authorized mixing zones ranging in size from 363 to 1,420 meters from the discharge point for Cook Inlet oil and gas facilities.

The size of the mixing zone that is required to meet water quality standards depends on the concentration of the parameter in the discharge water, how the water is discharged to receiving waters, and the characteristics of the receiving water. ADEC and EPA used the CORMIX dispersion model to calculate the dilution that the effluent plume receives and determine how far from the point of discharge water quality standards would be met. The radii of the mixing zones are shown in Table 2-2. The largest mixing zones would be necessary to meet water quality standard for total aromatic hydrocarbons (TAH)/total aqueous hydrocarbons (TAqH); the proposed mixing zones for existing facilities range from 36 to 3,016 meters (Table 2-2). Mixing zones for whole effluent toxicity, chronic metals, and acute metals would range from 31 to 1,742 m, 9 to 262 m, and <1 to 239 m, respectively (Table 2-2).

Most of the EFH species evaluated in the EFH are mobile organisms with extended geographic ranges that include areas outside the project area for the general NPDES permit. These organisms are unlikely to spend extended periods within the mixing zone boundaries. However, weathervane scallop and some prey resources, such as benthic and epibenthic prey organisms, are less mobile and might spend extended periods in some mixing zones.

4.3.2 Water Quality Standards

Because aquatic ecosystems can tolerate some stress and occasional adverse effects, EPA has not deemed it necessary to protect all species at all times and in all places (USEPA 1985). EPA guidance suggests that if acceptable data are available for a large number of appropriate taxa from a variety of taxonomic and functional groups, a reasonable level of protection would be provided if all but a small fraction (5 percent) of the taxa is protected (USEPA 1985). Thus, it is conceivable that an individual Endangerd Species Act (ESA)-listed species might not be protected by a water quality standard.

In June 2003 Alaska submitted revisions to its numeric water quality criteria for toxic and other deleterious organic and inorganic substances (18 AAC 70.020(b)) to the EPA for approval in accordance with Section 303(c)(2) of the Clean Water Act. The effect of the federal action of approving these criteria, which included acute and chronic marine criteria for the metals found in discharges from oil and gas production facilities (see Table 4-1), on all threatened and endangered species found in Alaskan waters was evaluated in a biological evaluation (BE) completed in January 2004 (Tetra Tech 2004). That statewide biological evaluation determined that the water quality standards for toxic and other deleterious organic and inorganic substances might affect, but were not likely to adversely affect, all the threatened and endangered species considered in the BE.

4.3.3 Effects on EFH

Several factors indicate that mixing zones and applicable state water quality standards, as they relate to the proposed project, would not have more than negligible adverse effects on EFH in the project area. The criteria used for mixing zones indicate that other than some organism near the outfall, no others would be adversely affected. The criteria for mixing zones, such as the requirement for no bioaccumulation of discharged parameters, and ensuring no lethality for organisms passing through the zones, would help ensure no marked adverse effects on EFH or their major prey resources. Also, as noted above, ADEC has determined that past permits have not resulted in persistence of toxic substances in the environment. In addition, the state has recently revised its water quality standards to help ensure proper protection of marine aquatic resources. A BE of the effectiveness of these standards to protect endangered or threatened species in marine waters included salmon species. The BE concluded that implementations of the water quality standards would not adversely affect any listed species (Tetra Tech 2004). Salmon assessed include EFH species that would be present in much of the project area. Water quality protection adequate for an ESA fish species is a good indicator of likely risk to other EFH species. Also, water quality standards undergo rigorous review to ensure that they protect aquatic organisms. These standards would be met at the edge of the mixing zone. The protections suggest that EFH species would be completely protected in the project area outside the mixing zones. Overall, some sublethal effects on EFH in the mixing zone, as well as indirect effect on EFH species from adverse effects on epibenthic and benthic prey species in the mixing zone, would occur. However, the relatively small area affected by the few discharge and exploration sites would have inconsequential effects on EFH in the project area.

4.4 Seismic Surveys and Boat Traffic

Seismic surveys and boat traffic both emit sound waves that might have adverse effects on EFH species. The types of adverse effects would vary from adverse physical effects on hearing organs to mild behavioral changes. The particular effects depend on the type, magnitude, frequency and location relative to the EFH species. MMS (2003) developed a detailed description of the types of effects and overall effects on EFH in most of the project area for activities associated with facilities in Cook Inlet. The following is a summary of types and magnitude of effects on EFH in the project based primarily on the MMS 2003 document.

Seismic survey might cover a substantial area of Cook Inlet (46 square kilometers, or 18 square miles) and would occur during brief periods (typically 2 to 10 days annually) in late summer and fall for exploration over a 5-year period. Only one survey is expected during development and production. Nearly all EFH species discussed in Section 3, along with other important prey species such as Pacific herring, Pacific sand lance, capelin, and eulachon, could be subject to noise emissions from seismic surveys. The spawning areas of some of the important prey species such as Pacific herring in Kamishak Bay would be unlikely to be affected because surveys would not occur there. Demersal fish and those near bottom areas would be the most likely to be subjected to increased noise levels from seismic surveys. It has been reported that fish can detect seismic air guns like those to be used at nearly 2.7 to 63 kilometers (1.6 to 39 miles) depending on water depth (MMS 2003). Also, some pelagic and nomadic fish have shown movement up to 33 kilometers from the seismic testing central area.

The direct effect on fish in close proximity to a seismic test is unclear (MMS 2003). However, damage to hearing organs has been documented in very close proximity to the air guns (a few to 20 meters) (MMS 2003). Gradually increasing the sound at the test site, however, could allow mobile fish to move away from the test area, thereby reducing the potential for adverse effects. Some of the best information on fish response to noise is from their reaction to boats. Often, many fish species would dive away from the surface noise of the boat. Herring in particular have been well studied. Pacific herring have often been noted to dive as a school away from passing boats, although they often return shortly (within seconds or minutes) to their original depth after boats pass. Typically, documented herring response to noise from boats has been much less than 1 kilometer (Misund et al. 1996; Valbo et al. 2002).

Unlike seismic surveys, project-associated boat traffic would affect only fish behavior and on a short-term basis. It has been estimated that the boat traffic for new exploration would be about 160 to 360 trips per year for 5 years. Each trip would be about 10 hours. This is a small number compared to other boat traffic in Cook Inlet, but it is comparable to commercial fishing boat activity in the region. As noted above, this type of activity would result in short-term (minutes) displacement of fish from boat passage and would be limited to fish closer to the surface, having less effect on demersal species.

The overall effect on EFH from seismic surveys and boat traffic would be mostly short-term and temporary. For seismic survey, because testing would be brief each year (2 to 10 days), over a limited area at any given time the major effect would be short-term displacement of fish responding to the sound. Most fish affected by seismic surveys would rapidly return to their previous location after completion of the tests. A limited number of fish might incur hearing damage that could affect their behavior and viability, but that number would be small. For boat traffic, fish would be displaced briefly (for a few minutes) during boat passage. Adverse effects on EFH from these noise-related activities would be very low and short-term.

4.5 Offshore Pipeline Construction and Operation

Prey and prey and fish habitat could be disrupted by the construction of pipelines primarily from increased short-term turbidity and burial of habitat from the pipeline (MMS 2003). Pipeline construction could consist of about 50 kilometers (30 miles). Past observations indicate an increased turbidity plume along the pipeline excavation of a few hundred to 1,000 meters. Although this turbidity would be near background in the natural high-turbidity environment of Cook Inlet, some burial of local benthic organisms (e.g., attached or surface organisms, including some larval fish) would occur along this route. The elevated plume would be short-term (2 to 3 hours), so overall effects would very localized and short term.

Some temporary loss of habitat and habitat modification would occur over an 18-acre area, assuming a 10-foot-wide disturbed area for pipeline construction in the shallow inner shelf habitat (0 to 50 meters). Additional habitat would be affected in the continental shelf (1 to 200 meters deep). In all these areas there would be initial loss of organisms and modification of habitat. It is expected, however, that lower food chain organisms (diatoms, polychaetes) would recolonize such areas in 80 days after construction. Disturbed fish habitat would likely be recolonized within 3 years (MMS 2003). In the short term, however, many of the demersal fish species and potential egg and larvae areas would be displaced.

Overall the adverse effects on EFH from construction of the pipeline would be slight to negligible due to the relatively small size of the affected population, the abundance of similar habitat in the region, and the short recolonization period for many species.

4.6 Accidental Oil Spills

Although the granting of the NPDES permit renewal does not authorize oil spills, issuance of the permit allows for associated activities that have the potential to result in oil spills. The MMS (2003) developed a detailed analysis of the potential for oil spills and effects on EFH in the project area. The following discussion is primarily summarized from that document.

MMS (2003) characterized the types of oil spills that could affect EFH into two categories–those less than 1,000 barrels and those greater than or equal to 1,000 barrels. The smaller spills (less than 1,000 barrels) can have some adverse, primarily short-term effects with some compounding, primarily very local effects unless occurring frequently; the larger spills could have long-term large effects that could radiate through the ecosystem.

Small spills (less than 1,000 barrels) are not expected to affect the overall quality of Cook Inlet. However, oil is toxic to many species life stages at low concentrations. It is likely that individuals (e.g., prey organisms, eggs, larvae) encountering oil, even at low concentrations could suffer deformities or mortality. This is especially true for some of the early life stages of some of important prey species (herring) and important EFH species such as intertidal-spawning pink salmon eggs (MMS 2003). Effects in intertidal areas could persist for generations and might have multiple effects by affecting more than one life stage. Other EFH species and life stages in the Cook Inlet area could be similarly affected. The overall effects of individual small spills on EFH would be small, however, because of the size of the area affected.

Large oil spills would be likely to have a worse effect on EFH than smaller spills. MMS (2003) modeled the probability of large spills. MMS estimated the probability of a spill of 1,500 to 4,600 barrels from project-related activities over the life of the project at 19 percent. This spill range is similar to actual spills that occurred in Glacier Bay (3,100 barrels), while it is only about 2 percent of the large *Exxon Valdez* spill (257,000 barrels) in Prince William Sound.

For comparison, initial impacts from the Glacier Bay spill were locally significant, but within a year most measurable parameters had returned to pre-spill conditions. In the Glacier Bay spill oil dissipated in less than a week, a total of ¾ mile of beach was oiled, and .63,000 sockeye salmon were discarded because of oil contamination. Within a year, only a few tar balls were visible, and no wetland or spawning beaches appeared to be affected.

Intertidal beach and bay habitats (primarily in Cook Inlet) are most likely to suffer long-term impacts if a major oil spill were to occur (MMS 2003). A large oil spill in the project area would adversely affect fish, EFH, and fish prey from lethal and nonlethal effects. Organisms that rely most heavily on these environments would be most affected. These include fish, such as Pacific herring, that spawn in intertidal and shallow subtidal habitat because they are very sensitive to oil. In addition, many eggs and larvae of other species are generally more sensitive to oil than adult stages. These fish species life stages would be more easily affected because of their sensitivity and their inability to avoid oil.

In these habitats the effects, though locally severe, would be expected to affect cohorts of a species within the Cook Inlet region but not affect the overall Gulf of Alaska region. The model developed by MMS (2003) projects that beaches within Cook Inlet would have a 20 percent chance of being oiled; the beaches most immediately outside Cook Inlet and larger bays within the Inlet (Kamishak Bay) would have only a 2 percent chance of being oiled if a large spill were to occur from project-related activities. If an oil spill originated in the outer portion of Cook Inlet, the chance of oil reaching Kamishak Bay would increase to 18 percent (MMS 2003). In intertidal areas, some of the species and life stages that might be most affected are Pacific herring eggs, Pacific sand lance and capelin eggs and adults, yellowfin sole, pink salmon eggs, adult squid, juvenile sablefish, walleye pollock larvae and adults, Pacific cod larvae and adults, eulachon juveniles, and Greenland turbo eggs (MMS 2003). Some of these species are primary prey species (e.g. herring, walleye pollock) for other EFH species, which could reduce production at least in the short term. Based on results from Prince William Sound, however, very large oil spills could influence the intertidal area for over a decade.

Lower Cook Inlet, including the open water portion, is considered an estuary. Large oil spills could affect the open water and demersal habitat of Cook Inlet, as well as the beaches. After the Prince William Sound spill, some of the demersal fish showed stress hormones even at depths of 60 meters (MMS 2003). The oil spill model projects that some estuarine areas in Cook Inlet (Kamishak Bay) and outside Cook Inlet (west Kodiak Island) have a greater than 33 percent chance of being affected by oil. Many species and life stages use these habitat areas, particularly the outer Cook Inlet areas, which have been designated EFH for many species (see Section 3). Some of the more common species are herring, rock sole, salmon eulachon, squid, sable fish and Pacific cod, and weathervane scallop. Adults would be able to avoid oil, but juveniles and larvae stages would be less able to avoid a spill and would be more at risk. Salmon smolts arriving in the estuarine environment might also be susceptible because they are small and often stay near the surface, where they would be more likely to encounter oil.

Any oil reaching marine waters outside Cook Inlet and nearby waters would have weathered at least 10 days and would be much less toxic (MMS 2003). This would greatly reduce the overall impact on EFH in these regions from oil spills. Marine waters seaward of Kodiak and Barren Islands have less than a 0.5 percent chance of being oiled even with a large spill. Although some eddy effect might keep some organisms (e.g., walleye pollock) in contact with oil for greater periods, the chances of this occurring are low. Although some contract with oil for demersal fish could occur, the effect should be slight to none because oil levels would likely be less than the state water quality standard of 15 parts per billion.

Overall adverse effects on EFH from oil spills would likely be low to moderate in magnitude and possibly of long duration. The risk of a large spill (1,500 to 4,600 barrels) is estimated to be 19 percent. A spill of that size could affect primarily beach and intertidal habitat because it would persist in those areas, possibly for more than a decade. However, the spill would affect a small portion of the total habitat and likely would be limited to subpopulation-level effects. Effects on other marine habitat (marine, estuarine) would be less because of limited effects on these areas and rapid recovery (months, few years).

4.7 Effect on Prey Resources

Prey resources for EFH species include a wide variety of items, such as zooplankton, euphausids, and various forage fish species. As noted above, the primary risk to EFH from the proposed action is from the oil spills related to development and operation of the project (MMS 2003). The

MMS (2003) document provided a summary of the types of effects that might occur on prey resources from all project actions in the project vicinity, with emphasis on a National Resource Council analysis on the effects of oil spills in the ocean environment (National Research Council 2002, as cited in MMS 2003). This information was used to provide the summary of effects on prey resources from issuance of the NPDES permit.

Acute oil spills can affect nearshore habitat such as marshes and can affect overall production and survival of organisms in both direct and indirect ways. Examples include reduction in attached algae, which in turn reduces limpet and other invertebrates that rely on this resource. This type of action could move through the food web, ultimately affecting EFH organisms.

Organisms can be exposed to hydrocarbon levels that are several orders of magnitude less than direct acute levels but still could affect feeding, growth rates, development rate, energetics, and other factors. Some low concentration of specific types of hydrocarbons (e.g., PAH) have been found to affect certain life stages of important forage fish (such as Pacific herring) at levels less than 1 part per billion (Carls et al. 1999). Marine zooplankton and euphausids might also be affected by toxicity from hydrocarbon concentrations. Zooplankton and euphausids (up to 70 percent of the walleye pollock diet) are important components of food to many of the EFH species, especially during early life stages.

Forage fish ultimately are the major prey for many of the EFH species. This diverse group of fish includes Pacific herring, Pacific sand lance, lantern fish deep-sea smelt, sand fish, gunnel, and many others. In addition, some life stages of some EFH fish, particularly walleye pollock as also major forage fish resources, with walleye pollock accounting for up to 80 percent forage fish prey in the Gulf of Alaska for some groundfish species. For Pacific herring, direct effects from oil spills can be marked if spawning success or early life stage survival is affected, as has been noted in Prince William Sound from the *Exxon Valdez* oil spill. Also, pollock juveniles are associated with eddies, which tend to retain oil. Therefore, there is the potential for oil spills to have both direct effects on these important forage fish and indirect effects on the predators that rely on them.

As noted in earlier discussions, project-related actions other than oil spills would have local adverse effects on prey resources. These effects, however, would be short-term and of small magnitude. Such actions might include pipeline construction, drilling discharges within the mixing zone, and seismic testing and boat operations that cause noise.

Overall, project-related actions might have adverse effects on prey resources for EFH species. These adverse effects would be related primarily to large or frequently occurring oil spills. Oil spills have the potential to adversely affect prey resources, including forage fish resources and ultimately EFH, by affecting EFH species' food supply. The magnitude is hard to predict, but if spills were large or frequent and occurred at critical times or locations, they could have marked adverse effects because they could affect the food chain, ultimately having population-level effects. If spills were less severe and were small, they would not be expected to have population-level effects. Other project-related actions would also have adverse effects on prey resources but primarily at local levels. They would be short-term and of minor consequence.

5.0 PROPOSED MITIGATION

The reauthorized NPDES permit would include several restrictions. The restrictions on regions of discharge (Section 2.1.2) would eliminate effects on critical areas. These permit requirements (see Section 2.3) include detailed restrictions on the different types of discharges under this permit. Part of the process includes detailed monitoring (Section 2.3.3) that would ensure that the characteristics of the permitted discharge would be met. In addition, new study requirements (Section 2.3.3.8) would be used to help understand the effects of large-volume discharges to the Cook Inlet marine environment. EPA and ADEC would use this information to determine whether any future changes are needed to the permit conditions to meet Alaska's Water Quality Standards.

6.0 ACTION AGENCY'S VIEW REGARDING EFFECTS OF PROPOSED ACTIONS ON EFH

Other than effects from potential oil spills, overall adverse effects on EFH in Cook Inlet and vicinity would be low and primarily short-term because of the limited magnitude and extent of the effects. Adverse effects from the discharge of drilling fluids and cuttings would be very limited in distribution and would be negligible. Processed water discharge would have slight adverse effects, but only at limited areas within inner Cook Inlet. The water quality standards administered at the edge of mixing zones would protect most organisms and EFH habitat; overall effects on EFH would be inconsequential because of the small area directly affected. Seismic surveys and boat traffic would cause very low adverse effects, primarily from short-term displacement of fish, but a very small number of fish could be directly harmed. Pipeline construction would disrupt habitat and initially bury prey and other resources, but rapid recolonization and the limited area directly affected by construction would render the effects negligible. Prey resources in general would suffer minor short-term adverse effects from all project actions unless substantial oil spills were to occur. Although the chances of substantial oil spills are small (estimated at less than 20 percent) they could have low to moderate adverse effects on local regions of the project area and possibly effects of long-term duration. The mitigative measures noted, including restrictions on the location of discharge, quality and treatment of discharge, proper construction methods and timing of activities, and discharge monitoring and testing, would aid in reducing the risk of adverse effects from project-related actions.

7.0 LITERATURE CITED

ADEC (Alaska Department of Environmental Conservation). 2003a. Alaska water quality manual for toxic and other deleterious organic and inorganic substances, as amended through May 15, 2003. Alaska Department of Environmental Conservation, Juneau, Alaska.

ADEC (Alaska Department of Environmental Conservation). 2003b. 18 AAC 70. Water quality standards, as amended through June 26, 2003. Alaska Department of Environmental Conservation, Juneau, Alaska.

Carls, M.G., S.D. Rice, and J.E. Hose. 1999. Sensitivity of fish embryos to weathered crude oil: Part I. Low-level exposure during incubation causes malformations, genetic damage, and mortality in Pacific herring (*Clupea pallasi*). *Environmental Toxicology and Chemistry*. 18:481–493.

Jones and Stokes (1990). (Cited in BE but not referenced there)

Misund, O.A., J.T. Ovredal, and M.T. Hafsteinsson. 1996. Reactions of herring schools to the sound field of a survey vessel. *Aquatic Living Resources* 9:5-11.

MMS (Minerals Management Service). 2003. *Cook Inlet Planning Area, Oil and Gas Lease Sales 191 and 199: Final Environmental Impact Statement.* OCS EIS/EA MMS 94-0066. U.S. Department of the Interior, Minerals Management Service, Alaska Outer Continental Shelf, Anchorage, AK.

NMFS (National Marine Fisheries Service). 2005. *Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska.* U.S Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Region, Juneau, AK. April.

National Research Council. 1983. Drilling Fluids and Cuttings in the Marine Environment. Marine Board, panel on fates and effects of drilling fluids and cuttings in the marine environment. National Academy Press, Washington, DC.

Neff, J.M. 1982. *Fate and Biological Effects on Oil Well Drilling Fluids in the Marine Environment: A Literature Review.* EPA-600/3-82-064. U.S. Environmental Protection Agency, Environmental Research Laboratory, Gulf Breeze, FL.

Neff, J.M. 1991 (cited in BE but not referenced there)

Osborne, J., and C. Leeder. 1989. Acute and chronic toxicity of base oil and cuttings from three wells drilled in the Beaufort Sea. In *Drilling Wastes, Proceedings of the 1988 International Conference on Drilling Wastes, Calgary, Alberta, Canada,* ed. F.R. Engelhardt, J.P. Ray, and A.H. Gilliam, pp. 481-494. Elsevier Science Publishers Ltd., London.

Parrish, P.R., and T.W. Duke. 1990. Effects of drilling fluids on marine organisms. In *Oceanic Processes In Marine Pollution,* Volume 6, ed. D.J. Baumgartner and I.W. Duedall, pp. 207-217.

Petrazzuolo, G., A.D. Michael, C.A. Menzie, H. Plugge, E.J. Zimmerman, R.G. Rolan, T.A. Mores, L.A. Smith, W.K. Parland, and S.E. Roth. 1985. *Assessment of Environmental Fate of Effects of Discharges from Offshore Oil and Gas Operations.* EPA 440/4-85/002. Washington, DC.

Tetra Tech, Inc. 1993. *Ocean Discharge Criteria Evaluation for Cook Inlet/Shelikof Strait Oil and Gas Lease Sale 149.* Prepared for U.S. Environmental Protection Agency, Region 10, by Tetra Tech, Inc., Redmond, WA.

Tetra Tech, Inc. 2004. *Preliminary Draft Biological Evaluation of the Alaska Water Quality Standards.* Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA by Tetra Tech, Inc., Mountlake Terrace, WA.

USEPA (U.S. Environmental Protection Agency). 1985. *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratories, Duluth, MN.

USEPA (U.S. Environmental Protection Agency). 1988a. *Final Ocean Discharge Criteria Evaluation for Beaufort Sea OCS Oil and Gas Lease Offering 97*. U.S. Environmental Protection Agency, Region 10, Seattle, WA.

USEPA (U.S. Environmental Protection Agency). 1988b. *Final ocean discharge criteria evaluation for Chukchi Sea OCS oil and gas lease offering 109.* U.S. Environmental Protection Agency, Region 10, Seattle, WA.

USEPA (U.S. Environmental Protection Agency). 1996. *Development Document for Final Effluent Limitations Guidelines and Standards for the Coastal Subcategory of the Oil and Gas Extraction Point Source Category.* EPA-821-R-96-023. U.S. Environmental Protection Agency, Region 10, Seattle, WA.

USEPA (U.S. Environmental Protection Agency). 2000. *Environmental Assessment of Final Effluent Limitations Guidelines and Standards for Synthetic-based Drilling Fluids and Other Nonaqueous Drilling Fluids in the Oil and Gas Extraction Point Source Category.* EPA-812-B00-014. Office of Water, Washington, DC.

Valbo, R., K. Olsen, and I. Huse. 2002. The effect of vessel avoidance of wintering Norwegian spring spawning herring. *Fisheries Research* 58: 59-77.